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Agriculture

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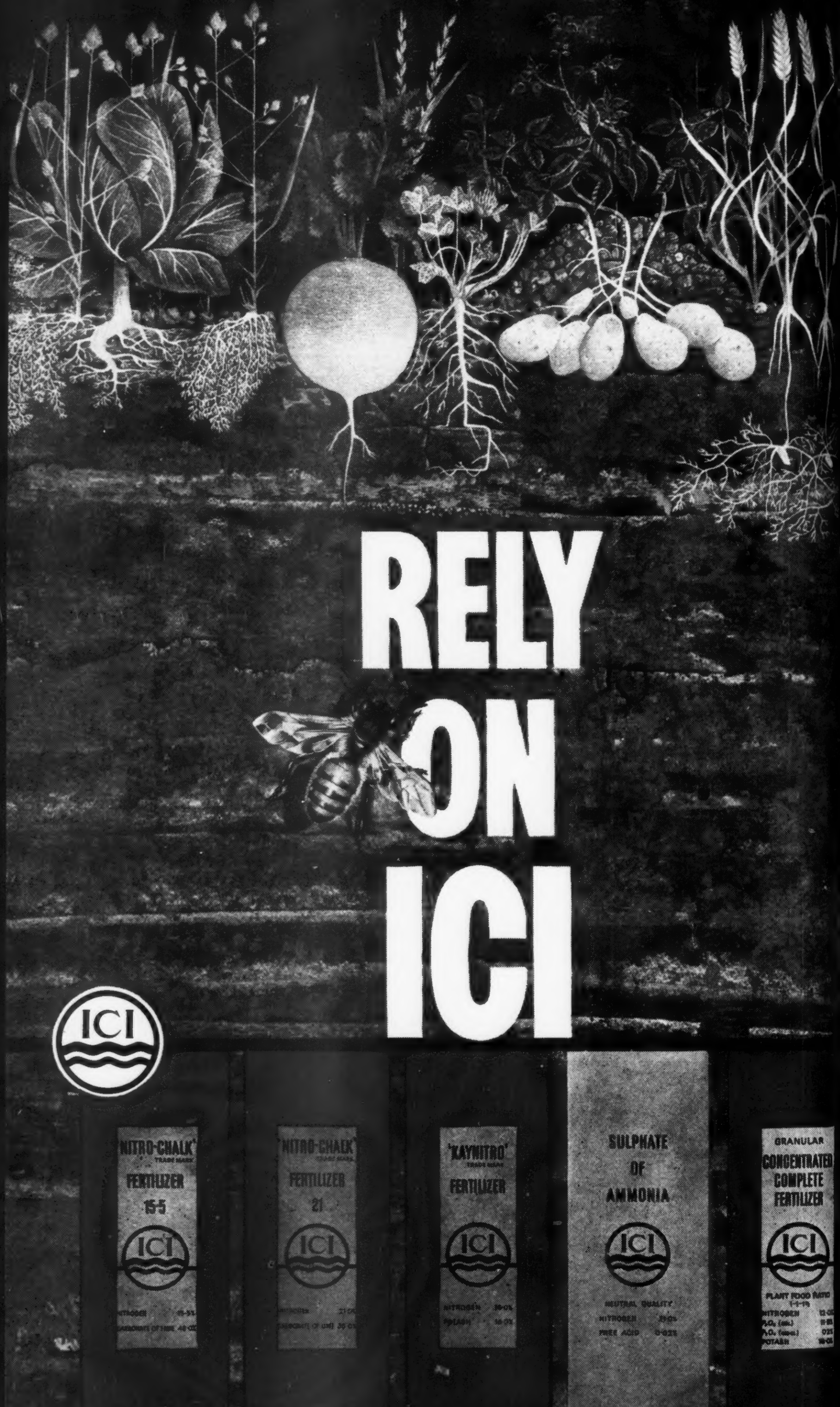

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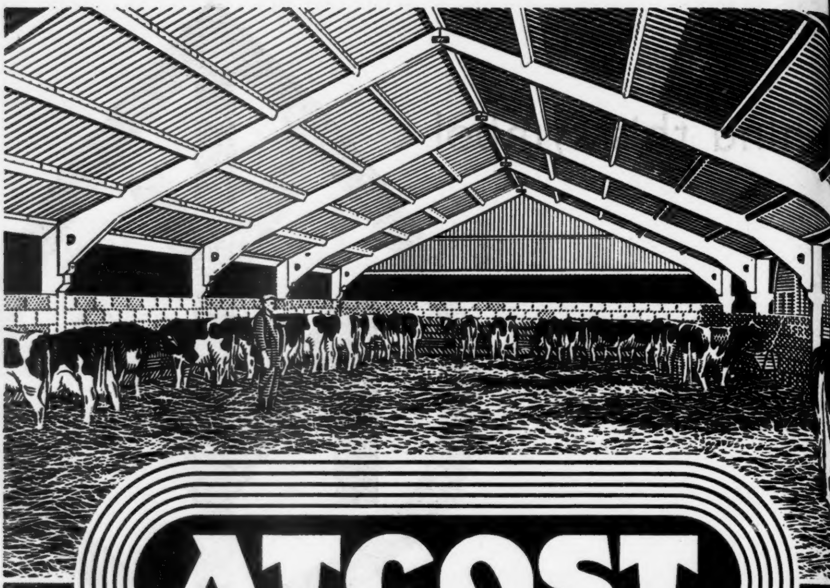

Agriculture

Volume 68 Number 3 June 1961

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Cover Photograph: Young Farmers in the Making at the Surrey Farm Institute

Photo: Fox Photos

Capital in Agriculture

V. H. Beynon, B.Sc.
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A short guide to calculating your capital needs, preparing a case for a bank overdraft and using the money when you have it.

In the past fifteen years, British agriculture has become the most highly mechanized in the world. This new farming has a voracious appetite for stock, equipment and operating expenses, and it is little wonder that farming capital has been much discussed over the past decade.

The following estimates by Cheveley and Price[1] show the magnitude of the capital changes which have occurred in U.K. farming.

	1938 £m	1953 £m
Landlords' capital	800	1,850
Tenants' capital	448	1,615
Total	1,248	3,465

The physical risks in farming have been greatly reduced by the increased investment in machinery, but the financial risks are undoubtedly greater. Now, a bigger proportion of tenants' capital incurs depreciation, maintenance and repair costs. Agriculture is also far more dependent on outside sources for its raw materials and services. On the small mixed farms of 80-100 acres in south-west England, the value of crops, stores, livestock and machinery is now about £50 per acre. The farmer also requires varying amounts of working or operating capital to pay for seeds, fertilizers, feedingstuffs, wages and other items used in farm production: the annual costs of these and all other expense items were about £14 per acre in 1947, but by 1958 the figure was nearly £35. Of course, part of this increase is attributable to new systems of farming and an intensification of existing systems.

Farming then, with its seemingly insatiable appetite for new inputs, has emerged as a commercial organization demanding a high standard of business acumen. Until recent years, management advice was obtained mainly from the Provincial Agricultural Economics Service. Now, the National Agricultural Advisory Service is giving more and more advice on the business aspects of farming. Are the available advisory services adequately equipped to advise on the efficient use of capital? One of the golden rules of success is that available resources, be they land, labour or capital, should be used in such a way as to yield the best return.

There is a dearth of information on capital returns in farming, and few, if any, text-books have included a ranking of enterprises according to the returns on capital invested. This task is very difficult, but despite this, some general comments are constantly being made about the relative merits of enterprises in relation to capital use. For instance it is often stated that cattle rearing and fattening locks up capital for long periods, whereas with dairy cows, cash receipts are obtained almost immediately. This would

explain why new entrants to farming so often select milk production—it economizes on working or operating capital. But to calculate the return on capital invested the following information is required:

1. The average capital employed must be calculated. Value of animals and equipment is fairly easy to assess, but there may be some difficulty in calculating the appropriate figure for working capital, because varying amounts are tied up for varying periods.

2. The appropriate profit figure must be determined. Many people would use gross profit, others the accountant's profit, while a few would allow for the manual and managerial work carried out by the farmer before computing his profit.

What is needed in planning a farm is information on the prospects a farmer may have of obtaining additional capital, and a rough indication of the capital demands of various enterprises so that the possible alternatives can be assessed. For most farmers, land and labour are the immediate limiting factors, and only the most obvious capital limitations should be considered in the initial stages. A technically sound, profitable and acceptable plan should be devised, bearing in mind limitations imposed by land, buildings and supply of labour. When this has been achieved a thorough understanding of the capital aspects involved "will contribute both to higher profits and a more relaxed attitude to your work and prevent your worrying unduly about a little red ink on your bank statement at various periods of the year".[2] How can these ideals be achieved?

Raising a loan

A full appreciation of the capital involved in operating a plan is important even on farms where ample capital is available. It is imperative where credit facilities are needed. A capital profile to show, month by month, the full impact of a plan for a new entrant to farming is set out in the Table below.

Capital Profile for First

Month	*Receipts* Milk	Cows and calves	Poultry and eggs	Crops	Sundries	Total	A.M.C. payments	Feed
Sept.								
Oct.	—	192	—	—	—	192	—	—
Nov.	726	—	108	—	—	834	—	300
Dec.	654	—	112	—	—	766	—	282
Jan.	608	—	124	—	—	732	—	254
Feb.	548	—	124	—	—	672	380	259
March	448	—	105	—	—	553	—	220
April	475	—	108	—	—	583	—	236
May	420	—	90	—	—	510	—	220
June	279	—	76	—	—	355	—	117
July	196	—	60	—	—	256	—	52
Aug.	149	—	72	—	—	221	380	35
Sept.	—	300	90	1,200	—	1,590	—	48
Total	4,503	492	1,069	1,200	—	7,264	760	2,023

*£930 spent on cows (£600) and poultry (£330).

This concerns the annual commitments of a dairy farmer purchasing at Michaelmas a £15,000 dairy farm of 100 acres with £5,000 of his own capital and a loan of £10,000 from the Agricultural Mortgage Corporation, which would be repaid by means of half-yearly payments of £380 over 30 years. The ingoing valuation in this example is assumed to be £540. The farm would be stocked with 36 autumn-calving dairy cows costing £3,600, and 300 pullets at point-of-lay costing £330. In addition it would have the minimum range of machinery and equipment necessary for carrying out the ordinary field cultivations, ensiling the grass crop, and doing the milking. With some secondhand equipment, the expenditure would amount to £2,450, making a total invested in tenant's capital of £6,920.

In this example the farmer hopes to arrange a bank overdraft of £3,000, which together with the rest (£3,920) of his own capital would be adequate to pay for stocking and equipping the farm. His net worth in a business valued at £21,920 would be £8,920, equivalent to about 40 per cent. This is a considerably better equity than most young farmers can achieve. Often in farming, assistance from members of the family and friends is used to supplement the facilities which the A.M.C. and banks can provide. The capital profile is used to demonstrate to the bank manager the merits or demerits of granting a £3,000 overdraft.

Receipts from the dairy herd and poultry enterprise, as well as the various items of expense, are budgeted for each month, and the bank balance calculated. The overdraft is reduced each month until A.M.C. commitments and corn growing expenditure are incurred in the spring. Unless noted beforehand, seasonal requirements of this nature frequently cause friction between the bank manager and his client. In this instance, shortage of capital prevents the farmer from fully stocking his farm. He plans, therefore, to introduce an enterprise which uses capital sparingly, and yet makes a substantial addition to profit. Barley growing fits in well, for investment can be

Year on a 100 Acre-Farm (in £)

Expenses								
Seeds and manures	Wages	Power and transport	Sundries	Private	Bank interest charges	Total	Surplus receipts over expenses	Debit balance at bank
								3,000
—	45	—	—	30	—	75	117	2,883
20	45	30	40	30	—	465	369	2,514
—	45	30	40	30	39	466	300	2,214
—	45	30	40	30	—	399	333	1,881
—	45	30	40	30	—	784	−112	1,993
220	45	40	40	30	—	595	−42	2,035
50	45	40	40	30	—	441	142	1,893
—	57	40	40	30	—	387	123	1,770
135	69	80	40	30	58	529	−174	1,944
—	57	80	40	30	—	259	−3	1,947
—	57	80	40	30	—	622	−401	2,348
25	45	80	970*	30	—	1,198	392	1,956
450	600	560	1,370	360	97	6,220	1,044	

kept low by using contract services and obtaining credit from the contractor until the crop is sold.

By economizing as much as possible on labour and private spending, the bank overdraft has been reduced during the year by £1,044. The profit of the farm is arrived at as follows:

	£
Surplus of receipts over expenditure	1,044
Excess creditors over debtors	−80
Increased valuation of crops and stock	320
A.M.C. capital repayment	115
Depreciation on implements and machines	−506
Increased net worth	893
Private expenses	360
Interest charges	97
Profit	1,350

Such a satisfactory first year in farming can be achieved by skilful management. But the object of the example is not to determine absolute levels of profit but to show what information should be made available when negotiating a bank overdraft. The capital profile should, of course, be extended for a long enough time to clear the overdraft completely. This is extremely important, for many plans have been abandoned because future commitments had not been adequately catered for. In particular it is important to estimate living expenses as accurately as possible, and to realize that cash may be short even when profits are satisfactory. This occurs when increases in farm valuations account for a large proportion of profit.

Farming with personal capital alone will become rare in the future as capital requirements continue to increase. Farmers will be forced to use credit facilities, and will become increasingly aware of the cost of borrowing money. In particular, new entrants to farming will have to avoid investing too much in elaborate buildings and machines. They will have to concentrate on the crops and livestock most likely to bring in a quick return and rely heavily on contract work. These rules have been observed in planning the example farm in this article. The Table shows the banker how large an overdraft is required, and when the loan is likely to be liquidated. Bankers are unlikely to turn down a request for credit facilities when detailed evidence of the soundness of the proposals is presented to them. Indeed it seems that for farmers capable of presenting and operating a sound project, there is no real shortage of available capital at the moment. Can the industry reasonably expect anything more?

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1. Capital in U.K. Agriculture Present and Future. Cheveley and Price. Netherhall Press.
2. Farming for Profits. K. Dexter and D. Barber. Penguin Books.

Labour for Cash Crops, 1930—1970

J. S. NIX, M.A., B.SC. (ECON.)

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This article outlines the decrease in labour requirements for the four main cash crops, potatoes, sugar beet, wheat and barley, over the past thirty years, and attempts to look ahead at what might be achieved by 1970.

TEN years ago the late Dr. A. W. Menzies-Kitchin, then Provincial Agricultural Economist at the School of Agriculture, Cambridge, wrote a report called *Labour Use in Agriculture*, after a three-month visit to the United States. In this he compared labour use on medium-sized farms of similar type in the Middle West of America and the Eastern Counties of England. In each case, farms were mainly arable, but usually had two or three livestock enterprises. Production per acre was similar.

There was a striking difference between the two countries in output per man, particularly in respect of crop production. In Northern Indiana, for example, one man was responsible for 267 acres of harvested crops compared with 32 in the Eastern Counties. Net output per man was nearly three times higher than in the Eastern Counties. It is significant that wage rates in the United States were twice those in this country.

As we shall see in this article, substantial progress has been made in Britain during the past ten years, but we are still some way from reaching the Middle West level of crop labour productivity even of ten years ago.

The relevant figures are presented in Table 1. Variable factors, such as the yields and the percentages of the crops given FYM, mean that the year-by-year figures are not *exactly* comparable in all respects, but they do give a broad picture of what has been happening.

Table 1

Labour requirements for cash crops, 1930-70 (hours per acre)

	1930	1950	1960	1970?
Potatoes	215	195	140	60
Sugar beet	235	180	120	20
Wheat	53	33	17½	6½
Barley	54	23	12½	6

In 1930, virtually all the work was still done by horses. Sugar beet and potatoes needed over 200 labour-hours an acre, and even cereals took more than 50. By 1950 the tractor had largely superseded the horse, particularly for the heavy work, and labour-hours for the root crops had fallen below 200 per acre. The combine harvester had also become important, particularly for barley; together with the tractor it considerably reduced the time required for an acre of cereals. Combine harvesting alone reduces labour-hours per acre by about 20.

Basis of 1960 figures

The 1960 figures are based on typical operations for each crop, and average times for each operation, recorded on many farms. The following

proportions of the crops are assumed to be farmyard manured: potatoes, two-thirds; sugar beet, one-half; wheat, one-tenth; barley, one-twentieth.

Today the farm work-horse is a rare animal in most areas, and other advances have been made. Most of our wheat and nearly all our barley is combine-harvested (80 and 95 per cent respectively are assumed in Table 1 for 1960), a large proportion of the potato acreage is machine planted, and about two-thirds of our sugar beet area is mechanically harvested. The latter reduces labour-hours per acre by about 40 on average, compared with hand harvesting. Mechanical loaders and spreaders are in widespread use for handling FYM. Much hand hoeing has been abandoned, partly because of higher labour costs and partly because labour is often simply not available for this job today. A further reason for the decline in hand hoeing, of course, is the great advance made in chemical weed control during the past decade.

However, the 1960 labour figures are still high, compared with the 1950 figures for areas in the United States quoted by Dr. Menzies-Kitchin in the report referred to above. The figure for potatoes, 140 (for an 8-ton crop) compares with 97 in Oregon for 12½-ton crops on irrigated farms. For sugar beet, our 120 hours (for a 12-ton crop) compares with 73 in Michigan in 1950. Though the latter is for a 9-ton crop, additional harvesting time for an extra three tons would be less than ten hours an acre.

What is quite certain is that the present-day United States figures are well below those of 1950, and would make our present achievements look even more moderate. However, to a large degree this is historically inevitable. To some extent also it is economically justifiable, in view of the high level of wages paid in the United States compared with this country, especially when considered in relation to the cost of machinery and the value of the crop.

Labour economy in crop production by 1970

What of the next ten years, however? Supposing the labour force continues to decline at the average rate of the past decade for all U.K. farm workers, 20,000 a year, and supposing the wage-rate continues to rise by nearly 10s. a week per year, while the price paid for farm produce, valued in real terms, rises little if at all?

The figures given in the final column of Table 1 are an attempt to forecast what might feasibly be the extent of further labour economy in crop production by 1970. Table 2 shows the detailed job breakdown of both the 1960 and 1970 figures, for comparison. The high figures and totals are rounded.

In Table 2 on p. 121, almost the same cultivation and manuring practices are assumed in 1970 as in 1960; it is the manner in which the work is done that is changed. It is assumed for 1970 that large wheeled diesel tractors and wide implements will be universally used and that fields will be at least 10 acres in size. Implements will be used in tandem where possible.

Farmyard manure will be mechanically loaded in the yard into mechanical spreaders and taken direct to the fields and distributed. The 1960 figure is an average obtained from many farms, using both hand and mechanical methods, much of the manure being moved in two or three stages.

For potatoes, the 1970 figure assumes the crop will be planted with an automatic planter, by the tractor-driver only, and that an efficient mechanical harvester will by then be in general use. The figure given assumes a rate of work of just over two acres a day and that four workers are required on the

Table 2

Detailed labour requirements for cash crops, 1960 and ?1970 (hours per acre)

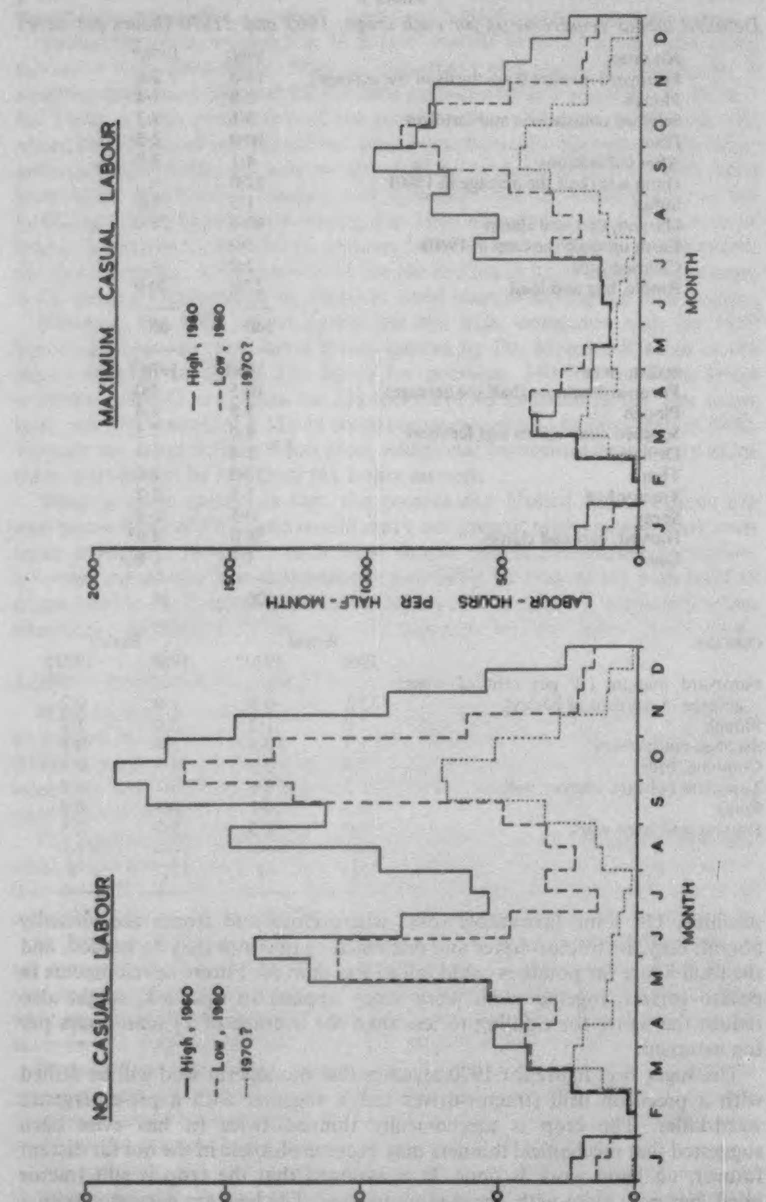
POTATOES	1960	1970?
Farmyard manure (two-thirds of the acreage)	14·0	2·6
Plough	2·8	1·4
Seedbed cultivations and fertilizer	3·1	1·7
Plant	10·0	2·5
After cultivations	4·1	3·0
Hand hoe (half the acreage in 1960)	12·0	—
Spray	1·5	1·0
Harvest, cart and clamp	60·5	28·0
Earth up (half the crop in 1960)	3·0	—
Clearing tops	2·0	—
Riddle, bag and load	27·0	20·0
	140	60

SUGAR BEET	1960	1970?
Farmyard manure (half the acreage)	10·5	2·0
Plough	2·8	1·4
Seedbed cultivations and fertilizer	4·0	2·5
Drill and roll	2·4	1·3
Thin	52·0	1·6
Tractor hoe	7·5	1·7
Spray	0·5	0·4
Harvest, cart and clamp	36·0	8·0
Load	4·7	1·0
	120	20

CEREALS	Wheat		Barley	
	1960	1970?	1960	1970?
Farmyard manure (10 per cent of wheat acreage, 5 per cent of barley)	2·1	0·4	1·0	0·2
Plough	2·0	1·2	2·0	1·2
Seedbed cultivations	1·4	0·8	1·4	0·8
Combine drill	1·3	0·6	1·3	0·6
Top dress (wheat), harrow, roll	1·2	0·6	0·7	0·4
Spray	0·3	0·2	0·3	0·2
Harvest and barn work	9·0	2·5	5·7	2·5
	17½	6½	12½	6

machine. On some favourable soils, where clods and stones are virtually absent, only the tractor-driver and one machine operator may be needed, and the total figure for potatoes could fall to less than 50. Future developments in potato sorters, together with work study applied to this task, might also reduce the figure for riddling to less than the average of 2½ man-hours per ton assumed.

The sugar beet figure for 1970 assumes that monogerm seed will be drilled with a precision drill (tractor-driver only), together with a pre-emergence weed-killer. The crop is mechanically thinned twice (it has even been suggested that mechanical thinners may become obsolete in the not far distant future); no hand work is done. It is assumed that the crop is still tractor hoed, but only twice with a mid-mounted hoe. The beet are harvested with a one-man machine into a rear or overhead hopper and unloaded into tipping trailers standing on the headland. When full, these trailers are taken to a


MAXIMUM CASUAL LABOUR
— High, 1960
-- Low, 1960
.... 1970?
LABOUR-HOURS PER HALF-MONTH
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500
1000
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J F M A M J J A S O N D
MONTH
NO CASUAL LABOUR
— High, 1960
-- Low, 1960
.... 1970?
LABOUR-HOURS PER HALF-MONTH
0
500
1000
1500
2000
J F M A M J J A S O N D
MONTH

concreted area, where the beet are dumped. It is estimated that one man can harvest and clamp an acre a day in this way. The beet are loaded on to the lorry for carting to the factory by means of a fore-loader which feeds the beet into a cleaning elevator.

Cereals in 1970 are sown without a man on the drill. They are harvested by means of a large capacity tanker combine, and the grain is handled in bulk in the barn and bulk loaded on to merchants' lorries.

Changes in seasonal labour requirements

What changes will be made in seasonal labour requirements by the changes envisaged in this article? The results are illustrated in the diagram on p. 122. The only job ignored is labour for potato riddling, which it is assumed can be fitted in during slack times for field work. For the sake of simplicity, and to emphasize the differences, a six-course rotation is assumed, consisting only of the crops referred to: potatoes—winter wheat—spring barley—sugar beet—winter wheat—spring barley. However, possibly a quarter of the winter wheat will have to follow another cereal crop, and a corresponding amount of spring barley will follow sugar beet, because not all the sugar beet will be harvested in time for winter wheat to be drilled.

Two separate labour requirement figures are used for 1960 in the diagram instead of the one composite figure given in Table 2. The latter averaged requirements for hand and machine potato planting, hand and machine beet harvesting, binder and combine grain harvesting, etc., according to the approximate proportion of each method in use at the present time. The diagram has a high and a low figure for 1960. In general, the low figure assumes a greater use of machines. The totals used, with notes, are given in Table 3.

Table 3

High and low labour requirements, 1960 (hours per acre)

HIGH REQUIREMENTS		
Potatoes	165	Hand planting (14 including ridging etc.), hand hoeing (24), earthing up (6), clearing tops (3), slow riddling (30)
Sugar beet	150	Hand harvesting (63 including carting and clamping)
Wheat	35¼	Binder harvesting (26¼)
Barley	32¼	,, ,, (25¼)
LOW REQUIREMENTS		
Potatoes	112	Machine planting (8), no hand hoeing, indoor storage, tops burnt off, faster riddling (24)
Sugar beet	102	Machine harvesting, one man machine (20 including carting and clamping)
Wheat	12	Combine harvesting (4¼ including barn work)
Barley	11	,, ,, (4¼ ,, ,, ,,)

Note 1. The figures in brackets indicate the labour-hours per acre for the jobs specified.

2. The same proportions of the crops are assumed to be farmyard manured in each case, i.e. potatoes, two-thirds; sugar beet, one-half; wheat, one-tenth; barley, one-twentieth. However, only hand methods are used in the high figures (average 27 hours per acre), while mechanical methods are at least partly employed in the low figures (average 15).

Taking the six-course rotation as a whole, man-hours per acre average: High 1960, 75; Low 1960, 43; 1970?, 18. The figures plotted on the diagram, however, exclude riddling and threshing, work which must be fitted in during the less busy months, particularly of the winter. Similarly the figures do

not include the general maintenance work carried out on the farm, which again can largely be fitted in during the slacker periods of the year. An additional 3 hours are required for each acre of combined straw baled and carted, mainly in September.

How many men to work 300 acres?

The results as regards the minimum number of men required to carry out the assumed rotation on a 300-acre farm are summarized in Table 4. The figures allow for wet days, sickness and holidays.

Table 4

Number of regular workers needed for October peak on 300-acre farm with rotation: potatoes—wheat—barley—sugar beet—wheat—barley.

	No casual labour		*Maximum casual labour*	
	Sunday work in October	No Sunday work	Sunday work in October	No Sunday work
High 1960	22	26	11	13
Low 1960	19	22	10	12
1970?	8	10	5	6

Separate figures are given for farms with no casual labour and for maximum casual labour. The latter means that casual labour is available for potato planting by hand, potato picking, hand hoeing of both potatoes and sugar beet, and for half the field work involved in harvesting cereals by binder. The only casual labour needed on the assumptions made for 1970 would be four men or women on the potato harvester.

With the rotation assumed, October is the peak month. There are then both potatoes and sugar beet to be harvested and the wheat land to be prepared and drilled. If the staff is prepared to work on Sundays during this month, therefore, the size of regular staff required can be reduced substantially.

With Sunday work, it will be seen that with no casual labour the labour requirement in 1960 varies from 22, or more than 7 per 100 acres, for the farm with high labour use, to 8, or less than 3 per 100 acres, in 1970 for the farm with the same cropping and general cultivation and manuring practices, but employing methods that reduce labour needs to a minimum. With casual labour available, the numbers required fall from 11, or nearly 4 per 100 acres, for "High 1960", to 5, or less than 2 per 100 acres, for 1970.

The crop rotation assumed is a fairly intensive one (save for exceptional areas such as the Fens), and it is also a rotation that causes a very high October labour peak. Programming would probably reveal that it would pay the farmer using the low labour 1970 methods to reduce his acreage of potatoes and sugar beet and substitute crops such as peas or clover with little or no October labour requirement; furthermore, that he should shift a higher proportion of the potato harvesting into September and more of the beet harvesting into November (if soil conditions will allow) than has been assumed here. If this were done, it is quite likely that the farm could be run with one man per 100 acres, even with, say, 10 per cent of the land in potatoes and 10 per cent in sugar beet. Maintenance work would not suffer, particularly if mechanical hedgers and ditchers were used, since there is plenty of time left for such work during the slacker months of the year, even allowing

for tasks such as potato riddling to be completed (possibly with the help of casual labour), and perhaps yarded beef or pigs to look after.

It is, of course, unrealistic to assume that all farmers will have achieved the labour figures given for 1970 in this article by that year. Nevertheless, there can surely be little doubt that many will have done so. Even if a potato harvester for all soil conditions is not perfected, work study has already indicated how picking and carting time can be reduced substantially compared with present averages. In fact there are a large number of farmers, even excluding those with extensive systems of cereal production combined with beef and sheep, who have already reached that one man per 100 acre figure. In the United States, with its high level of wages, any farmer employing a labour force comparable with that still found today on a high proportion of our farms would be well on the road to bankruptcy.

Quality in Tomatoes

R. GARDNER, N.D.H.

Director, Lee Valley Experimental Horticulture Station, Hoddesdon

What are the prime causes of poor quality in tomatoes, and how can we produce the highest possible proportion of top quality fruit?

QUALITY in tomatoes is the subject of much controversy. To most producers, quality is especially associated with fruit size, shape and colour, for these are the most important factors in deciding the grade and price of the fruit on the market.

To wholesalers or retailers, however, quality is related to the grading of the crop as a whole and to the market package. Home-grown tomatoes are usually packed in a box or basket containing 12 lb of fruit. At this stage of handling, the trader will buy or sell tomatoes of any grade designation required by consumers; uniformity and consistency of accepted designations for each grade of fruit are therefore of great importance.

Large retail sales establishments, such as chain stores, require uniformity and consistency in grading beyond the individual package or consignment. They want uniformity between batches of the same designated grade at any time or place. If consistency of grading of this order could be achieved the buying and selling of British grown tomatoes would be made much easier: buyers, large or small, would satisfy their requirements and place orders in advance with confidence, without time-consuming check inspections.

Why does not this happen now? Grade designations covering every condition of quality of the tomato fruit are already laid down in the schedule of grades published by the Tomato and Cucumber Marketing Board. The present inconsistency is due mainly to grading and packing being undertaken at so many points without any systematic attempt to achieve uniformity between one grower/packer and another.

In this respect the ease with which home-grown tomatoes can be placed on the market has proved a stumbling block; the provision of centralized facilities for grading, packaging and sale has seemed unnecessary and a cause of delay in marketing. On the other hand, imported tomatoes have generally to be assembled in bulk at certain points before export. Whether the grading and the application of export regulations are done at these points or at many smaller ones, the result is a high degree of uniformity and reliability of grading.

Additional facilities for bulk assembly, grading and packaging are clearly needed to achieve the same standards of uniformity for the home-grown crop, and the projected Regional Marketing Units sponsored by the Tomato and Cucumber Marketing Board are promising moves in this direction. The idea is spreading that centralized rather than dispersed facilities for handling home-grown tomatoes should be available on a nation-wide scale. If this approach can be brought to fulfilment it will put the home industry in a much stronger position to compete with overseas supplies. In addition, the door will have been opened to a fresh appraisal of production problems, with the improvement of fruit quality on the tomato plant as a first objective.

Production problems

What are the problems of producing tomatoes of a type and quality most required by the British consumer? And what aspects of fruit quality make the tomato attractive as a food? Grading and packing cannot transform a poor tomato into a good one. Again, efficient grading, packing and marketing are no substitute for the correct choice of variety, or for the high level of cultural skill which can ensure the production of top quality fruit.

Investigations at the Glasshouse Crops Research Institute have shown that the most palatable fruits are relatively high in sugars and fruit acids, and that small fruits tend to have the highest levels of sugars and acids, while large ones have the lowest. There are also significant differences in the levels of sugars and acids between one tomato variety and another. From experiments at present being conducted here at Hoddesdon it is evident that the composition of the fruit and its palatability can be influenced very considerably by culture.

Taking these results into account and relating them to the fairly abundant circumstantial evidence available, it seems safe to assume that the cultural factors exerting most influence on palatability are:

1. Light. An abundance of light results in higher levels of sugars and palatability.

2. Temperature. The effect of temperature varies with light, warmth in good light being beneficial. Excessive daytime temperatures, however, lead to the development of blotchy ripening and yellow back, conditions in the fruit which markedly impair palatability. The temperatures which favour high fruit quality may be taken as 63-65°F at night and 67-75°F in the day time—the day temperature relating to ventilated instruments protected from direct sunlight.

3. Soil moisture and nutrition. Maintaining a high level of soil moisture, especially under shade, depresses the percentage of sugars and dry matter. The effect appears to be most marked when wet regimes and poor feeding go together.

It is of interest that when temperature, watering and nutrition favour fruit quality, fruit size is reduced.

Quality as expressed by market grades

In view of the relationship between fruit size and eating quality, let us consider how far market prices and grading are related to fruit size. The British consumer seems to have a marked preference for relatively small fruit. The three premier quality grades cover a size range from about 1 oz to 3·2 oz per fruit, but on average, however, the highest market prices are obtained for the "pink and white" grade covering the size range 1½-2 oz, followed by the "white" grade 1-1½ oz, and lastly by the "pink" grade, with fruits of 2-3·2 oz.

Fruit size is not, of course, the only qualification for entry into one of the three top quality grades. The fruit should also be free from blemish, of even colouring, and reasonably round and smooth in outline. Tomatoes which are too large, or too irregular in shape, to enter the largest of the premier grades are graded "blue". In other respects, such as colour and eating quality, fruit of this grade should equal that of the three premier grades already described. Despite this, the price obtainable for blue grade tomatoes is often as much as 5d. per pound below the ruling price of pink and white. The British consumer not only prefers tomatoes of small size but is prepared to pay a higher price to obtain them.

The only other basic market grade calling for comment and used for fruit of good edible quality is that known as "blue and white". Like the white and pink and white grades, this covers fruit of approximately 1-2 oz in weight but which are insufficiently round in shape or regular in outline to qualify for either of those grades. It will be seen that the five basic grades provide for fruits of all weights from 1 oz up, and for all shapes within the prescription "round to oval or kidney shaped but otherwise reasonably regular".

What are not provided for, and rightly so, are the fruits suffering from blotchy ripening, yellow back, bronzing and other defects of maturation and colouring which reduce palatability. Given efficient grading, fruits suffering from these defects will be relegated to an unspecified grade which many growers at present call "roughs". Fruit in this category normally fetches very poor prices.

Experimental work is establishing a strong correlation between fruit size and susceptibility to such disorders. Small fruited bilocular varieties are proving less prone to them, especially to blotch and to bronzing, than large fruited multilocular kinds. Cultural techniques also play a decisive part. Those which encourage lean growth and smaller and firmer fruit make for resistance, whilst the enhancement of soft growth and large fruit appears to increase susceptibility.

Improving quality in the glasshouse

The scope for improving the quality of tomato fruits by right choice of variety and the adjustment of cultural techniques is considerable.

The first objective must obviously be to produce as much fruit as possible in the size range covered by the three premier grades. If we accept the pink

and white grade as being most desirable of all, the aim will be for fruits measuring 1 $\frac{13}{16}$ inches to 2 $\frac{3}{16}$ inches in diameter, say 1 $\frac{1}{2}$ oz to 2 oz in weight. At the same time, even colouring, round shape and a smooth outline must also be achieved.

In selecting varieties and forms of culture it will be helpful to consider varietal performance and cultural effects on the percentage production of pink and white grade fruit in complete crops.

Let us consider varietal performance first. At Hoddesdon in 1960, ten varieties of tomato were tested under six combinations of temperature. The results showed that certain varieties, such as Ware Cross and Ailsa Craig, were capable of giving about twice as much top quality fruit as certain other commercial varieties such as Potentate. This comparison held good at similar levels of temperature. G.C.R.I. 14 and Moneymaker were other very good performers in this respect. It is worth noting that a very large proportion of the Dutch tomato crop is of the varieties Ailsa Craig and Moneymaker.

Experiments on culture strongly support the view held by many growers that the quality of any tomato variety can be modified by cultural treatments. Thus, in an experiment at Hoddesdon sponsored by Dr. Cooper of the Glasshouse Crops Research Institute, the large fruited variety Potentate produced 24 per cent of pink and white grade fruit when given a favourable environment, whereas the percentage dropped to 7·5 per cent when the environment was least favourable. In the same two sets of conditions, however, Ware Cross produced 47 and 16·7 per cent respectively. Varying the cultural conditions exerted a considerable influence, therefore, on the amount of top quality fruit produced by both varieties, but the one was, under both environments, nearly 100 per cent better than the other. It must be said that the grading was severe, and aimed at eliminating from the pink and white grade any fruits which failed on a strict assessment to reach the specifications. Differences in susceptibility or resistance to blotchy ripening were also found when varieties and cultural treatments were compared. Some varieties, e.g. Moneymaker, will ripen evenly and without developing yellow back even in high temperatures and strong sunshine, while others are highly susceptible.

Temperature

Temperature has a marked influence on fruit quality. Warm temperatures lead to an increase in the proportion of top quality fruit, partly because they cause a reduction in fruit size. At Hoddesdon, for example, 52 per cent of pink and white fruits were picked from the variety Ware Cross growing in a warm night temperature regime (64°F), and 34 per cent in a cool one (58°F). Excessive day temperatures on the other hand frequently depress fruit quality, partly because of the increased incidence of blotchy ripening, bronzing and yellow back, and partly because more fruits split or have to be relegated to the "chats" grade (fruits of less than 1 oz).

Superficially, this result suggests that shading should be of value for the control of fruit colouring disorders. This might well be so if it were possible to shade the fruits without shading the foliage. At Hoddesdon, however, in each of two seasons shading has led to a decrease in the proportion of fruit reaching pink and white quality. The lesson is clear. High day temperatures must be prevented, but this is best done by improving the ventilation of the glasshouses and so avoiding the need for shade. Some of the best quality crops and highest

yields in the experiments at Hoddesdon have been obtained from the application of warm night temperatures (64°F) coupled with abundant daytime ventilation and a minimum of shade.

Watering and nutrition

As mentioned in the discussion on palatability, giving much more water than the plant needs, in the form of plain water, depresses fruit quality. The same is true of low levels of nutrition.

In the light of present knowledge the best advice that can be given is: limit the rate of watering to a little in excess of plant requirements, these being assessed by the use of an instrument such as a tensiometer, an evaporimeter or a radiometer. Nutrients balanced for nitrogen and potash should be fed in solution with each application of water and the running down of nutrient levels in the soil prevented. Detailed advice on how this can be done are given in the leaflet STL/8, *Liquid Feeding of Tomatoes*, which can be obtained free from local N.A.A.S. Horticultural Advisory Officers.

It is noteworthy that the pursuit of quality and palatability in the tomato crop generally implies a reduction in yield because of the smaller fruit, a sacrifice which growers can ill afford to make. Fortunately there is a way out of this dilemma. Cultural techniques can be applied which will increase the numbers of fruits per plant, and varieties are available which will produce large numbers of fruits of the desired sizes.

Crop Varieties and their Assessment

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It is the main task of variety testing to distinguish between the inherited characters and those which are mainly due to the soil, the climate or particular management of the crop.

SEEDS can affect the resulting crop in many ways. Naturally the first requirement is that enough of them should germinate and grow to establish a satisfactory crop; this aspect will be discussed in a later article.

The living germ of the seed carries the heritage of the crop plant which grows from it. The ability to yield well, the strength of the straw or stem and the resistance to diseases depend in the first place on the make-up of the living germ in the seed.

Other factors connected with the growth of the crop, such as time of sowing, nitrogen dressings and weather conditions, must of course have a big effect.

Although much is often made in advertisements of the high yield of a new variety harvested from a whole field, such information can be very misleading. Quite often the high yield is due to the skill of the grower, and there may be good reason to think that another variety would have given a considerably higher yield under the same conditions.

In judging the merits of a new variety, many aspects must be studied. These are not the same in all crops, but yield, field characters—including resistance to diseases and pests—quality, and special suitability are among the most important points. In most cases, but by no means always, it is the yield which has the greatest effect on the financial return to the grower. But in some crops such as vegetables for human consumption, the quality and the season when the variety can be marketed may be more important than total yield. In herbage varieties the length of life or "persistency" of the variety under grazing conditions may be of overriding importance.

Many of the features are related to one another. For instance, yield must depend upon freedom from disease, and in some cases unless the crop matures early enough there may be no yield at all.

Testing for yield

Because of the influence of the variable conditions of soil and climate, each new variety must be compared with a well-known older kind. It should thus be possible to place the new varieties in a relative order showing how they compare in yield with one another and with some of the well-known varieties. It is more important to know whether a new variety of spring wheat is able to beat Jufy I on average by some five or ten per cent than to know that it has given even a three-ton crop when grown in a single field without comparison with other varieties.

Because fields vary from one part to another, it is necessary to have more than one plot of each variety. Three of each may be sufficient if they are well distributed throughout the experiment, for instance in the "randomized blocks" of R. A. Fisher. In some crops, however, it may be necessary to repeat the varieties six or even eight times in suitably arranged plots to obtain a satisfactory indication of relative yield.

Good farming is just as necessary in running yield trials as in other successful branches of agriculture, and unless conditions for sowing, manurial treatment and general management of the crop are satisfactory the results of the trials may be misleading. When the yields from different plots of the same variety vary very much, the trial may have to be discarded.

To gain a fair idea of the probable behaviour of a new variety when it is introduced commercially, it is necessary to have a sufficient number of trials. Work at the National Institute of Agricultural Botany has shown that about twenty trials are required at well distributed centres over a period of years, to detect with confidence differences in cereal varieties of about five per cent in the yield of grain. It is generally better to have a larger number of trials with three or even with two plots of each variety than to attempt to concentrate the plots at a small number of centres.

The trial centres must of course be chosen bearing in mind the main areas where the crop is grown. If a few of the trials are placed on the fringes of the main areas or even just outside them, this is not necessarily a handicap.

Varieties which do well under a rather wider range of conditions in any one season are generally more likely to be successful over a run of seasons.

Three years is usually taken as the minimum time for conducting a full set of trials before a new variety can be recommended, though here again the really good variety usually succeeds well in comparison with other varieties even when the seasons are widely different.

Consistent yields are naturally to be preferred, and varieties which vary much from one season to another cannot be recommended with the same confidence. This may be particularly important in crops such as oats for home feeding or in contract crops.

Field characters

Varieties are closely watched throughout the period of trial. Very often this enables wide variations in yield from season to season or from place to place to be explained. For instance, Proctor barley, though eminently suitable for conditions in most parts of southern England, fails to mature in the field sufficiently early when grown in northern regions, so that both the yield and the quality of the crop may be reduced.

The importance of resistance to certain diseases cannot be over-emphasized. Potato blight may gravely upset the keeping quality of the tuber, and varieties which show resistance to this disease, particularly under field conditions, are of great potential value.

The intensive cropping of land with wheat, and especially winter wheat, has brought out the importance of resistance to eyespot. New varieties of winter wheat must be carefully compared with older varieties such as Cappelle Desprez which show high resistance to eyespot.

In the testing of oat varieties, resistance to stem eelworm may be the most important single factor, because crops can fail when susceptible varieties are sown on eelworm-infested land. The new winter oats Barnwell and Pennant are recommended to farmers largely on account of their resistance to oat stem eelworm.

Farmers in England and Wales are very fortunate in comparison with those in Denmark or Sweden in being able to grow varieties which are less winter-hardy. Nevertheless this is a point which must be closely watched, particularly if the growing of winter oats is to be extended towards more northern regions of this country.

The random distribution of plots of the different varieties within a single trial is helpful in making the field records. It is much better if the observer does not know the identity of the particular variety on which he makes his record.

Diseases such as yellow rust in wheat, and mildew in all the cereals, are greatly influenced by weather conditions. Sometimes the disease scarcely occurs during the two or three years a variety is passing through its trials. Consequently it is necessary to run special tests where plants of the different varieties can be deliberately infected with the diseases they may meet in the field. This involves quite highly technical work; in yellow rust, for instance, there are two or three different races of the parasite which may cause an epidemic of the disease.

Sources of seed for trials

The main task of variety testing is, naturally, to distinguish between the effects of plant breeding and those of cultural conditions. It is therefore very helpful if the seed for trials has been grown in the previous season side by side. This is perhaps particularly important in the case of potatoes, but even cereal variety comparisons can be upset if samples of very different germination have to be compared.

Many of the root, vegetable and herbage seeds present special problems in relation to variety trials. The seed of most of these kinds of crops is set as the result of cross-fertilization in the parent seed crop. This is very different from wheat, barley and oats where the same parent plant normally provides both the paternal and maternal contributions to the seed. It is different again from a potato variety such as King Edward which, being grown from a stem tuber and not from the seed, really represents one original plant. It may therefore be expected to maintain its uniformity, at least so far as the inherited characters are concerned.

Sugar beet, winter cauliflower and perennial ryegrass are examples of crops which are cross-fertilized and which therefore tend to differ over a period of years.

Naturally, breeders of these crops are constantly trying to improve their varieties or at least to maintain them at the same high level. Nevertheless the crop testing organization is presented with a special problem. It has to decide, for example, whether a sugar beet variety has improved or deteriorated over a period of years. The fact that the variety did well in trials in 1950 may mean little or nothing to the buyer of seed of sugar beet in 1961.

Fortunately, research work is enabling plant breeders to reduce the variation of their material from season to season, and to maintain the best selections at the same high level over a period of years.

Suitability for special conditions

It is often said by a farmer or a seedsman that a particular variety suits the conditions of a special area much better than a recommended variety. This may well be so in the case of peculiar conditions, but experience at the N.I.A.B. has shown that such claims are often based on a misunderstanding. It is very unwise to draw a hasty conclusion that, for example, a certain variety does particularly well on light soil until the point has been thoroughly investigated by trials specially arranged so that the factor of soil texture can be isolated from other influences. It is more frequently found that the variety which does best in the national series of trials over a wide area is still the best when taken into some quite specialized conditions. Nevertheless higher altitudes, regions with cold winters and late springs, some coastal regions in the south where crown rust in oats, for instance, is a serious disease, demand varieties which are specially suited.

The close co-operation between the N.I.A.B. and the N.A.A.S. provides for the testing of the more promising varieties in a much wider range of areas as soon as enough seed is available.

It is one of the aims of the FAO World Seed Campaign, which reaches its climax this year, that seed users everywhere should learn to appreciate the

importance of using the right variety, and this is a point which was emphasized recently in the reports issued by the Committee on Transactions in Seeds. The 1960 report draws attention to the importance of breeding a sufficient number of improved varieties to meet the needs of the industry, and recommends some financial protection for the plant breeder when his varieties are accepted and used in practice. The earlier report, published in 1958, deals in more general terms with transactions in seeds in this country.

In the United Kingdom farms and growers are free to choose and use whatever varieties of crop plants are available. The Committee in its 1958 report does recommend that cereal varieties should be tested for a period before they are sold commercially, so that some information is available from an independent source when a new variety is being widely advertised. The scale of this work is shown by the fact that in 1960 there were over 2,000 crop varieties under observation and trial at the N.I.A.B. Taking cereals alone, more than 60 new varieties are received annually for testing, but of these only a very small proportion, perhaps 3 or 4, are likely to prove sufficiently promising to be added to the Recommended Lists.

Whatever the terms of any new Seeds Act may be, it is certain that farmers depend very much on reliable testing of new varieties. Their close interest in variety trials conducted all over the country shows there is a growing recognition of the importance of this aspect in seeds. The interest of farmers is not only valuable to themselves; it can provide the N.I.A.B. and the plant breeding stations with most valuable practical information on their needs.

Discharge of Farm Effluent into Sewers and Streams

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Possible pollution consequences of new farm layouts and of farming operations generally are matters that cannot be left out of account today. This article sets out some of the more important legal and administrative aspects of pollution control in relation to farming. No attempt has been made to interpret the law—that is a function of the Courts.

IN the context of this article, by "farm effluent" is meant any noxious discharge, whether solid, liquid or gaseous in form, which emanates from the farm and finds its way directly or indirectly into a public sewer or stream. The term also includes any aqueous or gaseous discharge that raises the temperature of the stream or sewer into which it discharges.

Farm effluents can arise from a number of causes: the waste products of livestock; the use of chemicals, whether by spray or otherwise; dairy drainage, including the waste from farmhouse cheese, butter and cream production; the use of sheep dip, the discharge from silage production, etc. Of course, not

all these activities lead to pollution, but too often serious instances can be traced to carelessness or thoughtlessness.

Position up to the end of the war

Although farm effluent not infrequently found its way from the farm ditch into a nearby stream or public sewer, most farmers were subject in practice to little or no control in regard to the disposal of their farm effluent. Unless the pollution was particularly significant, the action of the farmer (or as was more generally the case, his *in*action) was not likely to constitute a statutory nuisance or to result in legal action to enforce any common law rights.

Part III of the Public Health Act 1936, which deals with nuisances and their definition, relates in practice more obviously to urban and industrial situations; thus few farmers have been served with abatement notices.

As regards the common law, in a well-known judgment at the end of last century* it was held that a riparian owner is entitled to have "the water of his stream, in its natural flow, without sensible diminution or increase and without sensible alteration in its character or quality". Where, therefore, a farmer discharges effluent into a stream he may risk a common law action that could result in an injunction restraining him from continuing the pollution or in an award of damages against him. Common law actions can be very expensive to the loser, and no doubt this is one of the reasons why few such actions have been brought, quite apart from the fact that aggrieved persons can generally find other and friendlier means to settle such disputes.

Before the war, it was made an offence under section 27 of the Public Health Act 1936 to pass into any sewer or drain linked to the public sewage disposal system matter likely to injure the sewer or drain, interfere with the free flow of its contents or affect prejudicially the treatment and disposal of its contents. The last-mentioned condition is of special importance to farm effluent, as the solid waste products of farm animals and the associated straw or other matter can present sewerage authorities with a most difficult disposal problem.

In the following year, the Public Health (Drainage of Trade Premises) Act 1937 was enacted. This modified section 27 of the 1936 Act in relation to the discharge into public sewers of effluent from trade and industrial premises. Industry was given certain conditional rights of discharge and the sewerage authorities were enabled to charge for the services provided. Although there is no reported case law, it is generally accepted that this Act did not apply to farm premises.

In regard to the pollution of streams, the Rivers Pollution Prevention Act 1876 had proved difficult to enforce, and in any case this Act was directed more to the mischief caused by the effluent from sewage works and from manufacturing industry. As regards fish-bearing streams, however, action can be and still is taken under the Salmon and Freshwater Fisheries Act 1923†. Section 8 of that Act makes it an offence to put knowingly into any waters containing fish (or into their tributaries) any liquid or solid matter

*The judgment of Lord Macnaghton in John Young and Co. v. Bankier Distillery Co. [1893] A.C. 691.

†The Salmon and Freshwater Fisheries Acts have been reviewed recently by a Committee under the Chairmanship of Lord Bledisloe. The report of this Committee has just been published.

to such an extent as to cause the waters to be poisonous or injurious to fish, the spawning grounds, spawn or the food of fish.

In sum, therefore, up to the end of the war the farmer was at little risk in regard to pollution, unless his action resulted in some serious and continuous pollution to the obvious detriment of others.

After the war

By the end of the war there was increasing concern about the polluted condition of many of the rivers and streams in this country. Although this article is concerned only with farm effluent, there were, of course, many and often more serious forms of pollution arising from the waste products of industry and from sewage works, and the position was exacerbated in some cases by abstractions which reduced the quantity of water in the rivers and therefore also the dilution afforded to polluting matter. The case for cleaner rivers was not merely a matter of aesthetics; there were cogent reasons concerning public health, the supply of drinking water, amenity and the future of freshwater fishing. Farmers, too, often need to have clean and wholesome water in streams for the watering of livestock and for horticultural and other purposes.

Apart from improving the law relating to pollution, it was necessary to improve its administration and enforcement. In 1948, the River Boards Act was passed. Following the recommendations of the Milne Report*, this provided for the establishment of river boards with responsibilities in relation to land drainage, pollution prevention and fisheries. The 32 river boards, together with the Thames and Lee Conservancies, extend over the whole of England and Wales except for the London area.

Rivers (Prevention of Pollution) Acts

The problem of the pollution of rivers was remitted to the Hobday Committee,† following whose report the Rivers (Prevention of Pollution) Act was passed in 1951. The preamble to the Act stated that it was "to make new provision for maintaining or restoring the wholesomeness of the rivers". Section 2 of this Act is perhaps of most importance to farmers. It made it an offence to cause any poisonous, noxious or polluting matter to enter any stream (which can include a farm ditch if it links with the nearby stream). New discharges or new outlets into streams may not be made without the prior consent of the river board. Powers are also given in section 3 of the 1951 Act to secure control of potentially polluting matter stored near streams. It is probable that not all farmers have always complied strictly with the provisions of the 1951 Act, but unless a farmer has been responsible for the regular and significant pollution of a stream, his arrangements in this regard have generally not been disturbed.

In 1960, the Clean Rivers (Estuaries and Tidal Waters) Act was passed, extending the provisions of the 1951 Act about new discharges to tidal, but not coastal waters.

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*The Central Advisory Water Committee: Chairman Field-Marshal Lord Milne (3rd Report, 1943).

†The Rivers Prevention of Pollution Sub-Committee of the Central Advisory Water Committee: Chairman Mr. S. R. Hobday (1949).

There is now before Parliament a Rivers (Prevention of Pollution) Bill, introduced by a Private Member, Mr. J. M. Temple, M.P., which is giving effect to certain of the recommendations of the Armer report*. If it comes into force, this Bill will require farmers (and traders and sewage authorities too) to seek the consent of the river board not merely for new outlets or new discharges into streams but for old discharges not controlled by the 1951 Act. A farmer will have twelve months or more to apply to a river board for a consent, and as soon as he makes his application he becomes immune from prosecution under section 2 of the 1951 Act in respect of that discharge. The immunity remains until the decision of the river board is given; usually it will be a consent subject to conditions. The river board is required not to withold its consent unreasonably nor to impose unreasonable conditions. The farmer, if aggrieved with the decision of the river board, will have three months in which to appeal to the Minister of Housing and Local Government: the above-mentioned immunity remains while the case is under appeal. The Minister's consent may be given with conditions attaching to it. Some time may, for example, be necessary before the farmer can reasonably be expected to make adequately improved arrangements; thus one of the conditions imposed may relate to the time by which the improvement can reasonably be made. Compliance with the consent conditions will render a discharge immune from pollution proceedings under the Salmon and Freshwater Fisheries Act 1923 and the Rivers (Prevention of Pollution) Act 1951.

Public Health Bill

Part V of the Public Health Bill gives effect to other recommendations in the Armer report. It was introduced in the House of Lords in November 1960, and it applies the Public Health (Drainage of Trade Premises) Act 1937 to farmers, with appropriate modifications. The Act has a provision to bring it into force two months after the Royal Assent. If, in the twelve months before the Act has come into force, there has been discharged into a public sewer any farm effluent (not just domestic sewage) from a farm, the farmer should serve a notice (giving details of the nature, composition and quantity of the discharge) on the sewerage authority. The immunity and appeal provisions are much the same as for river pollution, except that one of the conditions attaching to the consent may be a charge by the authority to the farmer in respect of reception and treatment of the farm discharge: this is also a matter on which an appeal can be lodged.

Action which can be taken now

In the debate in the House of Commons on 24th March 1961 on the Rivers (Prevention of Pollution) Bill, it was made clear that the new provisions were not expected to require panic action to put matters right. Nevertheless, it is not too soon for farmers and their advisers to consider the position of any farm effluent that may be finding its way into sewers or streams. Solid animal waste products ought not to be discharged into sewers: this matter can generally be used with advantage by the farmer as manure. Another item

*The Trade Effluents Sub-Committee of the Central Advisory Water Committee: Chairman Sir Frederick Armer (Final Report, 1960).

which can cause a particularly objectionable form of pollution is the discharge from silage-making. If proper precautions are taken when making and storing the silage it should be possible to prevent such a discharge from taking place.

The extension of the law, the improvements in the administrative and enforcement arrangements, and the greater awareness of the need to cleanse and keep clean our rivers and streams will mean that in the future farmers, along with industry and others, will have to pay greater attention to the discharge of matter into sewers and streams.

Finally, if there is a likelihood of some farm effluent unavoidably finding its way into a stream or sewer it is best before the discharge takes place to consult the river board or local authority respectively. The officers of these organizations are always prepared to help by advising what is the most suitable action to take in the circumstances.

Better Eggs—More Money

J. GETTY
British Egg Marketing Board

Why lose money on your eggs by careless handling and poor farm holding arrangements?

THE hen provides the egg with a hard shell which renders its contents invisible unless the egg is examined under a strong light. This is a good protection for the journey to the consumer's table but it also makes it difficult for the farmer to see how his handling is affecting the contents within the shell.

It is hard to convince many farmers that eggs are bought on a quality basis and that the deductions made on his grading return do in fact represent poor quality eggs which, if undetected, would reach the consumers and, by putting them off eggs, reduce the market demand and hence the price.

One of the main functions of an egg packing station is to remove faulty eggs and thus ensure that consumers get only the best possible egg.

When eggs were scarce there was a tendency to overlook quality faults, but now that home-produced eggs are plentiful, the consumer wants only the best. If this is not provided by the British farmer, then recent imports from the Continent show only too plainly that eggs will come in from overseas.

Cracked eggs

Cracks are responsible for 75 per cent of all the eggs downgraded to second quality, and a good deal of this loss could be avoided by more careful handling on the farm. The metal bucket is so often responsible; and this is still the most common receptacle used for collection. Allowing eggs to pile up in the nests, insufficient nest boxes and rough handling of eggs are all management causes of cracks. And they could easily be put right. Some recent tests carried out at farms have shown up to 20 cracked eggs present in a 30-dozen

case awaiting collection by the packer. This represents a loss of up to 2s. 6d. per case, and much of this loss could well be avoided.

Other factors which have an effect on the numbers of poor shelled eggs produced are feeding, housing temperature and strain of bird.

More difficult to detect but nevertheless harmful to the producer's interests are taints which arise in eggs through poor storage conditions. The egg shell is porous and the egg rapidly absorbs odours from strong smelling substances such as paint, fuel oil, creosote, onions etc. Having handled any of these substances, do not then go and collect eggs.

Egg washing causes a lot of trouble through the subsequent rotting of the eggs due to bacterial contamination, and unfortunately the rots do not arise in time to be rejected at the packing station—the consumer gets them.

The egg when laid is clean. If it is dirty when collected, then this is due to dirty nests or birds with dirty feet, and this again can largely be prevented by the farmer.

Cooling on the farm

Little attention has been given in the past to the cooling of eggs on the farm as a means of maintaining the innate quality of the egg. At the present time eggs may lie in the nest awaiting collection for the greater part of the day in temperatures which during the summer months will be 60-70°F or more. They may then be kept for a further period, which may be up to six days, awaiting collection by the packing station. When eggs are awaiting collection by the packing station they could be stored in a farm kitchen, meal store, dairy or other convenient point on the farm. Egg cases are collected in a variety of forms of transport, some in closed vans and some in open lorries. In both types of vehicles the eggs are subjected to heating by the sun's rays, and closed vans can become very hot after being out all day exposed to the sun's heat.

To maintain quality at its highest level the egg, which is laid at a temperature of approximately 106°F, should be cooled as quickly as possible to around 50°F and kept at this temperature throughout the chain of distribution until it comes to the table.

As it is not a practical proposition to air-condition the poultry houses to the required temperature, the solution to the problem here is to collect the eggs frequently throughout the day. Collection four times a day should be the farmer's aim. The galvanized pail is again not an ideal container, since its solid sides do not allow eggs to cool rapidly. The open mesh plastic containers are much more suitable for this job.

Frequent collection, apart from conserving quality, cuts down the number of cracked eggs which can arise through the bird entering the nest and walking over eggs laid by other birds. (Many farmers would be horrified if they knew how many cracked eggs they were in fact sending off the farm.) After collection, the eggs should be placed in a cool room, which should be maintained at a temperature of 50-55°F, or if it is not possible to have a room kept at this temperature, a cabinet could be installed fitted with suitable cooling equipment.

A suitably constructed egg holding room is an essential part of any programme to produce quality eggs, and this aim should not be confined

solely to farms setting up new poultry units but ought to be the objective of existing farms if they intend to remain in the egg production business.

Apart from temperature, the other factor which is to be considered in providing suitable holding conditions at the farm is humidity. An egg when stored under dry conditions will lose weight through evaporation of gases and loss of water vapour to the dry air. This decline in weight is sufficient in many cases to make an egg which when laid was, for example, in the Large weight grade category fall into the Standard weight grade category by the time it reaches the packing station. And this results in a lower price to the farmer. The humidity problem in egg rooms will be taken care of if the cooling equipment is installed to achieve the necessary temperature, as most systems produce a certain amount of ice which melts, so releasing water vapour to the outside air. If this is not sufficient, then it is possible for such egg rooms to provide a humidifying unit which will give control and allow the eggs to be kept at a humidity of 75-80 per cent R.H.

Continued care to point of sale

Having taken care of the conditions at the farm, it is of course necessary to stress that the collection vans should be insulated against the heat of the sun. Looking to the future, there is no doubt that we shall see before too long cooling units installed in the collection transport to keep the eggs cool during transit to the packing station and on their subsequent journey from the packing station to the wholesaler and/or retailer. This comment about cooled transport will apply to all sections of the egg distributing industry.

If the chain of cooling and quality maintenance is carried to the shop, then inevitably the eggs must be displayed in cooled cabinets for the housewife to take her pick. It would be unfortunate to keep the eggs cool at all stages up to that point and then allow them to lose quality at the point of sale.

With cooling to maintain the quality, there is no doubt that consumers would see a big improvement in the appearance of the eggs which they are currently buying, for during the summer weather egg quality does tend to decline to some extent, mainly through an increased amount of thin white and yolks which are spread rather more than normal. This is not surprising when we consider that the south of England has, on average, an air temperature of above 55°F for approximately six months of the year.

Obviously the need for cooling in the north of England, and particularly in the north east, will be less, although it must be borne in mind that where the hen houses or the storage conditions are kept in such a way that the air temperature rises above 55°F, then cooling becomes essential to maintain quality.

In conclusion, it should be stressed that naturally clean eggs, rather than cleaned ones, should be the aim of every egg producer, and if these are carefully collected and kept cool whilst awaiting collection by the packing station, then the home producer should be able to get a maximum return for his eggs and on quality grounds he will be able to compete with any imported eggs that may come into this country.

Slatted Feeding Platform for Dairy Cows

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The first winter's experience with a slatted floor feeding area which has been designed to save straw, to obviate the necessity of daily cleaning out, and to avoid the disadvantages of a completely slatted lying area for dairy cows.

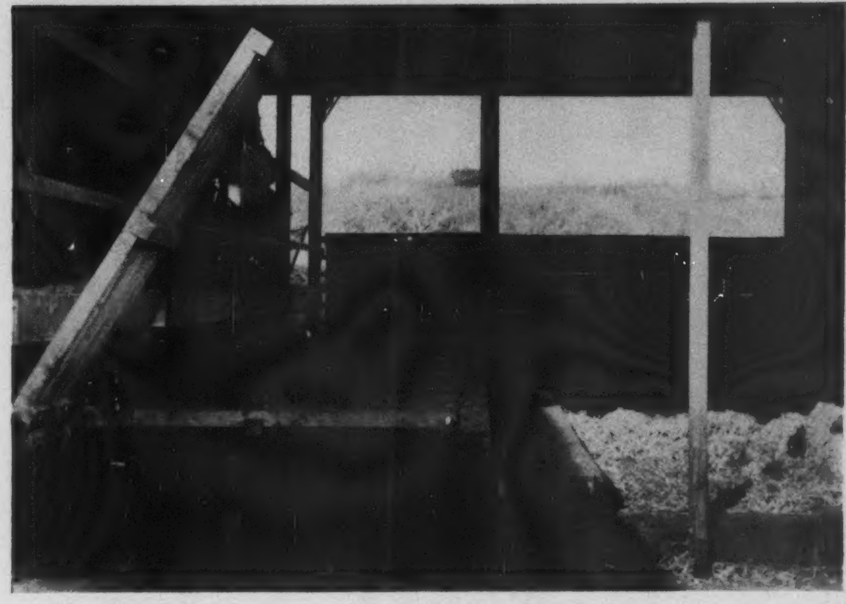
RECENT expansion of the dairy herd on the College Farm at Aberystwyth has increased the number of cows well beyond the capacity of the original cowshed. This has led to the introduction of a milking parlour, and a substantial proportion of the herd is now loose-housed in a well-enclosed Dutch barn. While this method of housing solves some problems it can introduce others; in particular it increases requirements for bedding straw, which can be a special problem in a mainly grassland area such as this, and necessitates the daily cleaning of feeding and collecting areas, together with the regular disposal of the slurry or sweepings.

To help solve both these problems, a slatted feeding platform 8 feet wide and 60 feet long has been installed in the covered yard, and has been in use for the latter part of last winter. It is 2 ft 6 in. high and is mounted by one intermediate step from the normal type of straw bedding area which lies behind it. Norwegian-type hay troughs run the full length of this platform, and are fitted with "floating" metal grids through which the cattle eat their hay. A rail at a suitable height above their necks prevents the animals from lifting their heads too high, and so allows any hay which falls during feeding to return to the trough. When filling the troughs with hay the metal grids are hung from the head-rail above, and since their lower corners remain tethered inside the troughs, they can form a temporary barrier against the cattle if necessary.

Three reasons for the installation

The installation of a slatted feeding platform was undertaken first of all to save straw. With housed animals, most dunging is known to take place when they are feeding and this can be clearly seen in slatted floor calf pens, where the build-up of muck parallel to the feed troughs can be twice as rapid as elsewhere in the pens. Much more milling-about and trampling also occurs in feeding areas than elsewhere in loose-housing accommodation. If this excessive movement can be confined to the feeding platform, contamination of the litter will be greatly reduced, especially since this platform lies along the whole of one side of the bedding area and no well-defined or persistent traffic lanes to it are set up.

The second purpose is to avoid the daily cleaning task associated with most types of feeding area. The platform is made up of panels, each one of which is hinged at the end nearest to the feed troughs, so that the whole floor can be raised to allow periodical removal of the muck beneath. This becomes a once-for-all job which need be no embarrassment even to a small labour force, for it can be carried out at chosen times during the winter or spring,



Slatted feeding platform in cross-section. The panels can be lifted for cleaning out.

Photos: *University College of Wales*

The platform in use on the College Farm at Aberystwyth.

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Y'S STATIONERY OFFICE

Above: Subsoiling on George Jarrett's farm at Umberleigh, N. Devon, when the subsoil was hard and dry. *Below:* In such ideal conditions, the tines have the maximum fracturing effect.

Photos: *George Jarrett*

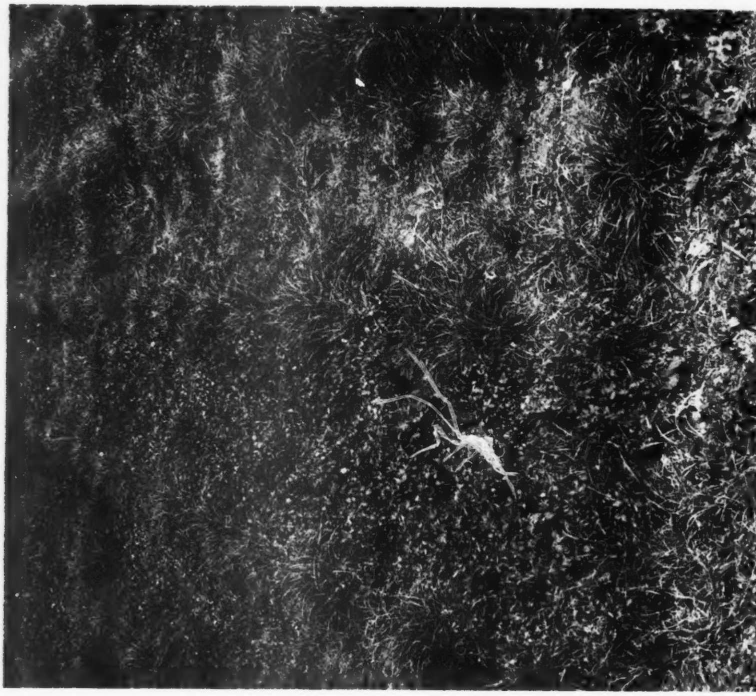
le on pp. 150-3)

Above: A grass field after subsoiling. Heavy rain drained off it in less than 48 hours. *Below:* A field near by, which was not subsoiled.

Photos: *George Jarrett*

Crop Varieties and their Assessment (Article on pp. 129-33)

Testing for resistance to loose smut by artificially inoculating the growing plants.



In this trial of clovers on land infested with stem eelworm, the susceptible varieties have been killed out.

Photos: *N.I.A.B.*

particularly when the land is in better condition to run on, for example during dry frosty periods. During the temporary storage period under the slats the muck tends to dry out, and provides material which is both easily handled and in a far more suitable state for mechanical application to grassland than either the slurry that is commonly swept from concrete feeding areas or the strawy muck that may be trodden under foot.

The third reason for installing this feeding platform was to study the method as a new development in the housing of dairy cows, and as an alternative to providing a totally slatted lying area which, whilst apparently successful with some other classes of cattle, does not yet appear to be wholly satisfactory for milking cows.

Structural details

In this case, because with certain previous slats we have had experience of elm warping badly, the timber is stress-graded sap free oak. Each panel is 8 feet long and 3 feet wide, with a 2 inch gap between the slats. Each slat is 3 inches wide at the top, 4 inches deep and $2\frac{1}{2}$ inches wide at the bottom, chamfered on one side only. This is because each pair is cut from a single piece of timber $5\frac{3}{4} \times 4$ inches. A timber centre support stands below each panel but is not fixed to it. The total cost of these prototype slatted floor panels, including the hinges and centre supports, was £140, or approximately 6*s*. per sq. foot.

The timber walling and steps on which the slatted flooring is supported, as well as certain partitions in the barn itself, have been made by farm labour with the use of railway sleepers and wagon sole bars, so that should any structural modifications become necessary they can readily be made. Furthermore, since the timbers are simply slotted into the channels of the steel stanchions it would be a straightforward matter to readjust the feeding and bedding layout within the general limits of the barn itself, to suit, for example, any changed requirements for hay or silage storage.

The bedding area can be varied considerably, but this year the total area, including slats, has been 66 sq. feet per cow, and the straw area alone has been 42 sq. feet per cow.

Economical of straw and labour

The limited evidence that we have gained so far this winter, when the animals in the barn have been housed at night only, indicates that after an initial layer made up very largely of an old stack bottom, we have used 3·6 lb of home-grown barley straw per cow per day. This would work out at approximately 6 cwt of straw per cow for a 180-day winter, or 5 cwt per cow for a 150-day winter. At these levels of consumption the farm could remain self-sufficient for straw.

When resting, the cows are almost invariably in the strawed area, and they appear comfortable and keep clean. They show no inclination to lie on the slats. On the other hand, at hay feeding times, they mount the steps to the feeding platform eagerly and confidently and with no hesitation whatsoever. Initially, the first of these steps was 16 inches high and the second, to the platform itself, 10 inches, but as the depth of the litter slowly increases the height of the lower step is gradually reduced.

Although a 2 inch gap between slats is used fairly commonly for adult cattle and appears to be satisfactory in this case, nevertheless a 1½ inch gap might be more comfortable, and with the very effective treading which takes place on the feeding platform the floor would almost certainly keep clean.

So far as labour requirements are concerned there has as yet been no cleaning out whatsoever, and a few bales of straw, stored immediately adjacent in the same building, are simply added to the bedding area every few days. Since the baled hay is also stored under the same roof and immediately behind and along the full length of the troughing, the labour of hay feeding too is reduced to a minimum. As this set-up has only been in use for approximately two months, it is unlikely that we shall find it necessary to remove any of the bedding after this winter. The bed so far formed will probably be allowed to dry out and provide a useful base for starting on next year.

Advantages of hay-feeding

Because of certain important physical characteristics of the farm as well as its heavy stocking rate, we find that in our case it is better to depend mainly on hay rather than silage. A significant reduction in hay wastage during feeding has been brought about by the introduction of the Norwegian type of troughing. In any case it is also important to keep the slats free from blockage by fallen hay. In extreme contrast to slats used where silage is self-fed, these slats are dry and non-slippy, and this is an extremely important point. There may also be less widespread contamination of the actual litter with hay-fed cattle. Certain other advantages of hay-feeding, such as ease of handling and of winter mobility and simple control of the total quantities fed, as well as the better storage use that can be made of the full height of the Dutch barn (including if necessary a floor above the bedding area) are also clearly apparent. A static feeding platform of this sort might thus lose some of its advantages where large amounts of silage were fed. Studies on the use of this type of feeding platform will be continued during the coming autumn and winter, and they form part of a general programme of investigation into the winter housing problems of dairy cattle under our predominantly grassland and high rainfall conditions.

A Pedigree Dairy Herd from Scratch

D. E. H. Cowles

St. Dials, Monmouth

The facts and figures of building up a pedigree dairy herd on a 180-acre Monmouthshire farm.

I have been asked to write something of the methods we have used in trying to build up a dairy herd from scratch and of the way we feed it. We try to get high yields by the sensible combination of home-grown and concentrate feeding, and from personal experience on our type of farm, I believe my arguments are irrefutable. In the first place I want to make it clear that I consider myself an average farmer with an average amount of below average land and strictly limited capital: I can only hope I am endowed with average intelligence.

We farm in Monmouth borough just a mile from the town; the 180-acre farm is situated on a slope, the land is heavy, wet and the greater part of it steep. Although most of a field in April is workable, we quite often have to delay sowing because of wet patches where the water oozes from a rock seam not far below the surface.

Before 1940, my father, who had bought the farm in 1925, maintained a pedigree beef herd (one cow to one calf) and carried about 65 cattle and 80 breeding ewes, ploughing at the most 11 acres for wheat and roots. One lesson I gained from helping with the cattle then was the value of good feeding. I married a dairy farmer's daughter in 1942, having taken over the farm and the beef cattle from my father the year before. We were both very interested in pedigree cattle and met with some success at shows and sales. However, our accounts for the year 1944-45 showed a loss of £35, and to do something about it we decided to sell milk from, to begin with, half a dozen cows besides continuing to run the beef herd.

In September and October 1945 we bought 10 dairy cows of about ten breeds and started selling milk. It was not all honey; there were early mornings with storm lanterns in cold unsuitable buildings (constructed of galvanized iron) and aching wrists, as neither of us had milked before. Added to this, three of the most expensive cows, bought attested in October, failed the T.T. test in April and had to be sold. We have not had a reactor since. However, we got by and were quite impressed by having received enough cash by mid-April to pay for the cows.

Changed objective

This fact, coupled with the loss of an expensive beef bull, made easier our decision to increase the milking cows and get rid of the beef herd. To compensate us for our loss in pedigree, we decided to grade up a Friesian herd. A pedigree herd seemed a long way off, and in fact it has taken us fifteen years to achieve 95 per cent pedigree or grading register cattle. With a dairy herd, one can get a living more easily on the way up; with a pedigree beef herd, the pinnacle is a very desirable place but the path is steeper.

Grading up from all breeds is a hazardous job and while first results tend to be spectacular, I think that most people will have found it essential to buy the odd pedigree female of the family they fancy in order to speed up the process. This does not necessarily mean spending a lot of money, but rather a careful study of the breed and breeders!

Our aim has always been the same, not just a collection of cows (which is all that is really needed for profit from milk sales) but to develop a first-class herd to improve the farm and keep out of debt. We have tried to use the best bull we could get. At first a proven sire was sought and a great deal of importance was placed on paper records, but proven sires today are very hard to obtain and we have learnt that milk and fat are only two of the essentials, others coming easily to mind being type, temperament and perhaps, most of all, udders that wear.

We have had our trials and disappointments and plenty of bull calves, but on the whole we have been fortunate in being able to develop our cattle with three R.M. bulls, two of whom were closely related, and we have followed them with a particularly well-bred son of the one from the best family in a very good and successful herd. A number of good bulls are available now for nominated insemination but we don't seem to have much luck with deep frozen semen.

Today we are farming the same 180 acres and we rent 18 acres of grass keep besides, having taken the plough around most of the ploughable acreage. We have some 100 acres of what is termed in Monmouthshire "tenants pasture", about 25 acres of wheat grown for cash sale and straw, 6-8 acres of kale, 5 of potatoes, 2 of mangolds and usually a catch crop of rape.

The herd is now 130 strong, of which 45 are in milk, all the heifers and a few steer calves being reared. Seventy breeding ewes are lambed with a view to selling the lambs as early as possible; in the spring of 1959 we had sold 100 lambs by 17th May.

Grazing plus cake

Kale is strip grazed by the cows from mid-October onwards, and when this is finished they go on to medium quality silage (about 30 lb per day at the most) and about 20 lb of mangolds fed whole. We like to feed a little good hay all the year round, just enough to tie the cows up to in summer, and about 10 lb per day in winter and spring. One of the biggest problems is that often we have good grazing of grass or kale and it is too wet to get the cows near it. Last winter on kale, washing the cows gave us more work than milking them. Often they had to be kept in for a few days. The same problem arises with early bite; by the time it is dry enough it is no longer early, or having had a dry spell and the stock turned on for a few days, it rains and they have to return to the old bare pasture.

It will be realized, therefore, that while we can supplement feeding off the farm, we are bound to buy concentrates and this has been our policy. We buy in cake form mainly because it is less wasteful, easy to ration and the preparation and mixing is done by someone who should know far more about nutrition than we do. The cows are steamed up for 5 or 6 weeks before calving with a maximum of 12 lb of dairy cake according to the time of year. Incidentally, we calve all the year around to maintain a fairly high level contract with a local retailer; the surplus is sold on a second contract.

In the dead of winter the production ration is 4 lb of cake for every gallon, but I want to emphasize that the cake for each cow is weighed for each feed and put into separate buckets. The cake sheet is altered weekly in accordance with the milk weigh sheet.

In April we aim at getting up to 3 gallons off grass, and doing this till about the end of June. In the spring of 1959 we had three cows producing 30 gallons per day for five weeks; each was receiving 21 lb of cake per day so each was producing 5 gallons from grass. I quote this little instance because it is typical of many we see where forage farming is advocated and where figures are quoted to show how much milk is produced off a certain pasture without telling us anything about the feeding of the cows before they were turned on to that pasture. I know of some herds fed so badly through the winter because it is supposed to be economical that not only are they kept at a loss before the grass comes, but when it does come they are too dry and too bare to take any advantage of it.

Looking at the cost

As to the cost of feeding our cows, I am taking a period ending in 1960. During that twelve months, 30 cows and 15 heifers completed their lactations, producing something over 1,400 gallons each for the cows and nearly 1,000 gallons each for the heifers, an overall average of 1,277 gallons. This in terms of cash gave us over £8,800 or an average return of £195 per animal.

Each animal was maintained by what we could produce on the farm, but it was cake fed for all but something less than one gallon per day. Each consumed (steaming up included) an average of 38 cwt of best dairy cake at a cost of just less than £67. Taking £67 from £195 leaves us with an income of £128 per animal after all concentrates are paid for. This means that we should have to obtain an average of 830 gallons per cow and per heifer alike and to keep the same number, in order to obtain the same cow income, without concentrates. To put it another way, to be as well off, total milk yield must have an overall average of 1,000 gallons, using less than one pound of cake per gallon. Our average, without concentrates, would have to be some 70 gallons above the national average (obtained by all types of feeding) before we should be as well compensated financially.

I agree that £67 for cake alone is a high figure, but I maintain it is an economical one on any farm. And it does not end there, for as a rule, well-fed cows are treated as individuals and respond to that treatment, culling is practised to a far greater degree, and consequently herd improvement is much more pronounced. If you have animals which are capable of producing 1,000 gallons, it seems to me to be stupid to take only 700 gallons from them because of what amounts to under-feeding.

I reckon the overhead costs alone amount to £1 per cow per week—translated this means that a cow only just breaks even with a yield of 560 gallons; this is exactly the yield at which the University of Bristol, in a recent survey, found there to be no profit all. They also found that a cow giving 2 gallons a day shows a profit of 2s. 4d. whilst the 6 galloner will show a profit of 11s. 5d. From the facts which Bristol obtained from average dairy farms, it is clear that with sensible rationing the profitability from milk increases up to a point by about £11 for every additional 100 gallons given by the cow.

Practice matched to enterprise

I always admire those who make a success of any farming enterprise and, no doubt, on suitable farms, milk can be produced without concentrate feeding, but I think the people who do this are specialists to a far greater degree than those with a 1,400 gallon average, and the highly successful ones are more rare.

The danger as I see it lies in those of us less fortunate with our land trying to copy these specialists. I have often seen an expensive layout for milk production which has put a millstone around the farmer's neck, where the land, the cattle and the management will obviously never justify it. Quite often the best plan would have been to manage with existing buildings and first improve the cattle and feed them better.

I don't claim to be producing milk by the only good method, but it suits us here and it has enabled us to provide and pay for enough buildings to house our cattle in winter, to have greatly improved the farm, to find a ready demand at good prices for the 25 or so cows and in-calf heifers we sell each year. And we trust just to get on to the bottom rung of the bull-breeding herd ladder.

If more attention were paid to sensible feeding, little trouble would be found with butterfat and solids. For those who appreciate STOCKMANSHIP and breeding behind their cows, individual rationing for the highest economic yield can be profitable and will help the satisfaction which some of us can only get from continual improvement.

Yorkshire Grassland Society's Soil Map

An outstanding feature of the Yorkshire Grassland Society's Journal (issue no. 3 of 1961) is a soil map of the county, printed in 13 colours, which was prepared at the request of the Society by Mr. A Crompton of the Soil Survey of England and Wales, with the help of the N.A.A.S. and Leeds University. To accompany the map, Mr. Crompton has contributed an informative article on the soils of Yorkshire.

Copies of the map, with a reprint of the article, may be ordered from Mr. John Illingworth, 2 Manley Grove, Ben Rhydding, Ilkley, Yorkshire. Single copies cost 2*s*. 6*d*. each, 12-99 copies 2*s*. each, and 100 or more 1*s*. 6*d*. each. Young Farmers' Clubs and Farmers' Discussion Groups in particular will be interested.

Wilting for Self-Feed Silage

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National Agricultural Advisory Service, Yorks and Lancs Region

The practice of wilting, to guarantee well-made silage from young, leafy herbage, offers scope in planning the efficient use of farm labour and machinery and in reducing feeding costs, through improved grass conservation techniques.

EXPERIMENTAL work has proved conclusively that well-made silage from young leafy herbage may be obtained by pre-wilting and chopping or lacerating the fresh crop. Forage harvesting deals effectively with chopping or lacerating, and is now common practice. But in spite of all the evidence, many farmers and advisers appear to be reluctant to pre-wilt because they feel that introducing another operation would slow up and increase the cost of silage-making. This report compares and contrasts results obtained from silage-making and self-feeding on a Lancashire farm in 1959-60 and 1960-61. In the first year disappointing results were obtained because the silage was rather too mature and poorly made. In 1960 the farmer was advised to cut earlier and to pre-wilt before ensiling.

The farm concerned is in the Fylde. Approximately one-third of it is devoted to arable cash crops, whilst the remainder—reasonably intensive grassland—supports a large herd (70-75) of pedigree Dairy Shorthorns, plus replacement followers. The aim is to combine commercially profitable milk production with high yields and opportunity sale of pedigree stock. Winter feeding consists of strip- or zero-grazed kale plus limited self-feed silage to start with, and full self-feed silage at the end of the winter. Supplementary concentrates consist chiefly of cereals and contain 13-14 per cent of crude protein. The herd is conveniently divided into high and low yielding groups (above or below 3 gallons daily), which self-feed and loaf in adjacent parallel silos and yards. Information presented here refers to the production of first-cut grass silage for self-feeding, and the results from the higher yielding groups in each of the two years. Because the herd is gradually being increased in size, the acreage of grass for silage and total cow numbers were higher for 1960-61 than 1959-60.

Silage-making

The same 3-man team was used in both years. In 1959 all the grass was cut directly with a flail type forage harvester, but in 1960 forage harvesting was carried out on grass that had been cut with a mower and allowed to wilt for at least 24 hours.

It is not claimed that this represents the ideal wilting time, which will, of course, vary according to weather conditions, and also depend on available labour, machinery and general farm conditions. Apart from the initial mowing, silage-making proceeded on similar lines in both years, with one man forage harvesting, one man carting to the silo, and one man buck-raking on to the silo. In 1960 mowing w ıs carried out during early morning by one man, whilst the others were engaged in milking, moving electric

fences and preparing harvesting machinery, etc. To counteract the possible danger of overheating in the silo, the wilted grass was heavily consolidated and the top foot of settled silage was made from directly cut herbage. Table 1 compares harvesting performances in both years.

Table 1
Harvesting performance. Unwilted compared with wilted silage

	1959-60 (*Unwilted*)	1960-61 (*Wilted*)
Acres harvested	51	90
Total yield of settled silage (tons)	350	410
Settled silage per acre (tons)	6·9	4·6
Total yield of silage dry matter (tons)	66·5	111·5
Silage dry matter per acre (tons)	1·30	1·24*
Working days required per 3-man team	17	17
Acres harvested per day	3·0	5·3
Settled silage harvested per day (tons)	20·6	24·1
Silage dry matter harvested per day (tons)	3·9	6·6

*During silage-making in 1960 it was found that the forage harvester did not pick up all the grass from the 5 ft swathe left by the mower. The material left was harvested as very good hay, and averaged 3¾ cwt of hay per acre. The total average yield of conserved dry matter in 1960 was therefore 1·41 tons per acre. The use of swathe boards would probably ensure complete picking up by the forage harvester.

The results indicate that wilting speeded up silage-making in 1960 compared with 1959, because of the larger acreage of herbage it was possible to handle daily. Three factors appeared to contribute to this:

1. The increased speed and ease of working of the forage harvester in wilted grass.
2. The increased weight of dry matter per load of wilted grass, and
3. Buck-raking the wilted grass on to the silo appeared to be accomplished more quickly and easily.

Silage quality and feeding value

The 1959-60 silage was poor. Although silage-making began reasonably early (in the last week of May), with a fairly leafy crop, the final product was on average a wet, medium-protein silage with a butyric acid type of fermentation and a slightly ammoniacal smell, caused by overconsolidation of the very wet herbage.

In contrast, in 1960 silage-making started two weeks earlier, and the resultant silage had a good fermentation, a bright yellow colour, a sharp acidic smell and was fairly stemmy, but also contained a high proportion of leaf. Average analytical results for both years are shown in Table 2.

Table 2
Chemical composition of the silages

	1959-60 (*Unwilted*)	1960-61 (*Wilted*)
pH	5·2	4·3
Per cent dry matter	19·0	27·2
Per cent crude protein in dry matter	13·2	15·2

As expected, results from self-feeding the wilted silage were much better than those of 1959-60. The increase in stock numbers made it necessary to restrict self-feeding to 12 hours a day in 1960-61 to ensure that silage lasted

throughout the winter. Briefly, it was found that the rather more mature and poorly-made 1959-60 silage was not very acceptable, although average daily intakes eventually reached 90-95 lb per cow. The high milk yields desired were maintained only by feeding a very high level of concentrate, and all attempts to reduce concentrate intake caused a fall in milk yield. In 1960-61, despite restricted access to silage, milk yields were maintained with one-third less concentrate per gallon, and had the cows been allowed all the wilted silage they could eat, concentrate usage could have been reduced further. The summarized feeding results are given in Table 3.

Table 3

Feeding results on wilted and unwilted silage

		1959-60 (*Unwilted*)	1960-61 (*Wilted*)
Fresh silage consumed per cow per day (lb)		90-95	75-80
Silage dry matter consumed per cow per day (lb)		17·1-18·0	20·4-21·8
Concentrates fed per gallon (lb)		4·5	3·0
Type of concentrates	Starch equivalent	62	65
	Per cent crude protein	14·0	13·8

Accurate comparisons of milk yields are not possible because of changes in cow numbers, and also because of a switch from thrice-daily milking in 1959-60 to twice daily in 1960-61. Evidence from milk records shows that yields in 1960-61 have been maintained as well as, and possibly better than in 1959-60, despite the change from thrice-daily milking. The data in Table 3 certainly illustrate the advantages of pre-wilting a less mature crop to provide a more digestible and better silage that is more acceptable to the cow. Some of the improvement is probably due to lower ensiling losses when making wilted silage.

Because the above data were obtained in two different seasons, they cannot be accepted as critical experimental proof of the value of wilting. But they do seem worthy of record because they show that advice to pre-wilt is sound and that pre-wilting can be introduced into farm practice with beneficial harvesting and feeding results.

Subsoiling

GEORGE JARRETT
Clevedon, Somerset

Subsoiling is a much misunderstood means of breaking up a compacted layer of subsoil, to allow either the natural drainage or an existing drainage system to work. It will also encourage crops to develop deeper roots.

SUBSOILING is the key to better crops, earlier and later grazing from our grassland, and improved drainage coupled with better conservation and utilization of rainfall. Properly applied, it can revolutionize the productivity and profitability of thousands of acres of arable and grassland. Yet it remains one of the most neglected and misunderstood operations in the farming curriculum. Too often it is confused either with mole drainage or deep ploughing.

During the past ten years or so I have been devoting a quite considerable amount of time to a study of subsoiling—from Devon to the Shetlands. The results have been so promising that I have become enthusiastic over the whole subject.

It will be remembered that at last year's Royal Show at Cambridge, the Ministry of Agriculture gave considerable attention to the ill-effects of soil panning and the need for subsoiling. This excellent demonstration was, however, held in the centre of a big arable area, where subsoiling, or "busting" as it is sometimes called, is already widely practised. What really concerns me is the lukewarm interest for the subject in other districts and the lack of enthusiasm for a basic operation.

By and large one finds that the mention of the word "subsoiler" immediately conjures up a barrier of fear of bringing raw subsoil to the surface. Here we see the creation of a mental pan instead of the plough pan which we are seeking to eliminate. Let us make it quite clear that subsoiling does not bring subsoil to the surface, except for the odd lump which may come up with the subsoiler tine at the end of each run.

Subsoiling is necessary wherever there is an impervious layer under the top few inches of soil through which water cannot penetrate or roots develop. This condition is known by various names, including plough pan, hard pan, clay pan, plough sole, etc. The pan can be formed naturally, or it can be caused by the continuous use of rubber-tyred tractors and the passage of heavy equipment over the land, by continual ploughing to the same depth and even by better farming—producing better stock-carrying leys which can also contribute to the packing of the soil. Several factors may share the blame.

But whatever the reason the results will be the same: reduced yields from shallow-rooting crops and an increasing tendency to waterlogging. Grassland which has never known the plough can be as badly in need of the subsoiler as the arable areas, and although the subsoiler has largely been used in areas with a low rainfall to catch and conserve such rain as does fall, it is of equal value to areas with a higher rainfall where so much is lost through evaporation.

Advantages over direct drainage

In the wetter areas the natural thought is towards direct drainage, but this can be a rather extravagant method of dealing with water that later in the season may be badly needed. To get a clear picture of this water business, let us liken rainfall to money. In any type of business there can be times when income is well in excess of immediate needs, but we do not forget that the money will be badly needed before very long. With this in mind, therefore, we bank our money until the time arrives for us to spend it.

Yet what do we do with the rainfall from which our water supplies are derived? In times of excessive rainfall we direct it from the field by tile drains to the nearest ditch, and thence to the nearest river and down to the sea, sending with it plant nutrients and often valuable soil. Where drainage is poor, water lies on the surface, prevents our grazing or working the land and eventually is lost by evaporation. On hillsides, surplus water which cannot penetrate flows down over the fields and causes soil erosion. Even where fields have a drainage system the land is often so panned that the surface water cannot get down to the drains.

In thinking of water conservation and the effect of a subsoil pan perhaps the following illustration will be of help. Suppose we build a square concrete box six inches deep, with a tight bottom, and leave the top open after we have filled the box with an average loam soil. If we then put it outside we shall find that about three and a half inches of rain will flood the box. The absorbent matter and the air spaces between the soil particles will be filled with water.

Water "banks"

If more rain falls, the surplus water must run over the top and be lost because there is only room for the three and a half inches of rain; the hard bottom of the box will prevent any natural seepage downward. This is exactly what happens to thousands of acres of our land on a much larger scale. The rainfall just cannot penetrate and get down to the lower layers of soil where it can be conserved, as if in a reservoir, before rising again to the surface in dry times by capillary action. Those subsoil areas are our water "banks", waiting for supplies during wet periods and releasing them slowly at others. But if impeded drainage prevents rainfall from penetrating beneath the top few inches of soil there will be no moisture reserves later on.

Where these hard pans exist root development is restricted in the same way as a plant in a flower pot becomes root- or pot-bound. Root systems will be shallow and breathing space for the plants reduced to the minimum. By opening up the subsoil areas deeper root development is encouraged, and drainage and water conservation are improved. Roots will be able to draw moisture and nutrients from a much bigger area.

Confusion about mole draining

As mole drainage is so often confused with subsoiling, perhaps it would be as well to make a brief reference to the two operations. Both are done with implements which are very similar in appearance. The mole drainer, however, depends on a horizontal torpedo-like mole for drawing a round channel through a suitable clay subsoil, which must be of the right texture to prevent

the channel from collapsing. The work should be done when the subsoil is moist, whereas the subsoiler should only be used when the subsoil is hard and dry, so permitting the maximum fracturing. It depends, too, on a narrow tine about 2½-3 inches wide which enters the soil at an angle, and as it is drawn at the desired depth—12-20 or more inches—it exerts a busting and fracturing effect on the whole depth from ground level to where the tine is set. Walking behind a subsoiler at work one can see and feel the whole of the area on both sides being moved.

Whereas the mole drain depends mainly on getting water right away from the land, subsoiling, whilst improving drainage by lowering the water-table and taking the water down lower, allows only excess water to find its way to field drains and ditches. In effect we are reducing complete loss of water to the minimum, whereas orthodox drainage seems to aim at complete removal of the maximum.

Drainage is such an esoteric subject that one must not attempt to be dogmatic; every case must be judged on its merits. Where it is necessary to have a tile drainage system at least ensure that it is going to work. Subsoiling in conjunction with tile drainage can reduce the number and cost of tile drains by something like one-third. In one field where we carried out some experimental subsoiling last year, the subsequent heavy rains revealed an old drainage system which had probably been installed well over a century ago and was seen to be working for the first time for many years. The subsoiler had so broken the clay pan that water was able to get down to the drains.

Is your land too dry or too wet?

On this same farm experimental work has been carried out which includes subsoiling for two opposite reasons. One field so treated has been suffering from excessive wet, whilst another on the same soil formation dries out each summer. We have not yet had an opportunity to report on the effect of subsoiling the latter field, but that subsoiled to counteract excessive wet has already proved the value of the work done.

Another field subsoiled last summer was the only one in the district on which winter wheat could be drilled; yet another was the only one which could be sown out to autumn grass seeds. Both crops have come through the excessively wet winter remarkably well. In another instance subsoiling enabled a field to be stocked until the end of last November, whereas previously even in normal years it was always unstocked at the end of September. The saving in hay brought about by subsoiling and later grazing was estimated at about £60.

On some of my own land in North Devon part of a field subsoiled in June 1959, when subsoil conditions were really hard, yielded results during the past winter which have been sufficiently encouraging to warrant subsoiling as much as possible of the rest of the farm, some of which persisted in remaining exceptionally waterlogged throughout the winter. Had we been able to harvest the corn from this field we could have drilled winter wheat.

Subsoiling some Exmoor fields just before the great Lynmouth flood disaster produced good reports. From one area it was reported that the subsoiled land was able to cope even with the terrific downpour of rain which occurred, whilst on another Exmoor estate it was reported that the subsoiled areas had allowed the land to be grazed earlier each spring.

One point should be made clear in regard to subsoiling. It is not claimed that it will eliminate surface water completely, but it does prevent waterlogged conditions persisting over a long period. We have observed over several years that on land where persistent waterlogging always occurred, the water would disappear within something like 24-48 hours after subsoiling.

I have always been strongly in favour of tackling this subsoiling with a crawler tractor, as the maximum surface grip is always required to draw the subsoiler. In the eastern counties a fairly powerful crawler is invariably used. Normally I like to subsoil about 18-24 inches deep according to subsoil conditions, with the cuts about 3-4 feet apart. This ensures moving the maximum amount of subsoil. I like the crawler to use as low a gear as possible, in order to produce the best fracturing effect.

Costing

In costing such work, remember that for the maximum benefit it must be done when conditions are at their hardest, and that a lower tender may not always prove the most economic if it is at the cost of depth or width of working. In working out the economics of subsoiling against the price per acre, try to assess the value of say, an extra six weeks' grazing a year arising out of extending the grazing season on fields previously too wet to be stocked too early or too late; or the possible saving of a third of the cost of tile drainage; or the estimated value of better yields of crops which can be sown earlier than land that cannot be touched for a fortnight or so because of waterlogged conditions. Under arable conditions ploughing is found to be easier after the subsoiler.

Why buy first-class ley mixtures and then be deprived of their maximum benefits because the land they are sown on lies too wet, with the loss of several weeks' productivity a year, and possibly the loss of plant in the year of sowing through water lying too long on the surface? Subsoiling will, more often than not, cure these conditions.

Subsoiling can be carried out on permanent grassland without spoiling the sward, and the deeper the work the less surface disturbance there is. The approximate life of the job must depend on local conditions, both soil and climatic of course, but I think one could safely quote a figure of from four to eight years. Again, in some seasons on some farms the initial cost can be saved in the first year.

Subsoiling is certainly one of the most interesting agricultural subjects to study, whether on one's own farm or on other people's. In the lower rainfall areas it can be done to conserve moisture, whilst in the wetter areas it can be used to lower the water-table by allowing the heavier rainfall to penetrate deeper into the subsoil and letting only the surplus drain away completely. On arable land it can form the basis of a policy of plough shallow and subsoil deep.

Modern methods of farming, without subsoiling, will soon amount to abuse of our soils. By greater attention to this operation, we may one day be confident enough to be judged on the basis of the belief that the farming development of a country can be measured by the depth of its tillage.

Planning the General-Purpose Farm Building

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Carefully planned, and with well-made and thoughtfully placed fittings, one building might be made to serve most purposes, especially on the smaller farm.

IN these days of progress in agriculture, adaptability in farm building is very important, and the ideal farm building may consist of a simple inexpensive roof covering a floor large enough for the total farm enterprise, with the sides closed in where necessary. The space thus enclosed, equipped with semi-permanent fittings, could be adapted when required to cope with changing requirements in husbandry and farm management. Farm buildings involve the long-term investment of a great deal of money. In addition, about one-half of the expenditure on labour is spent in or around the farm buildings, so if capital and labour are to be used to the best advantage the buildings must obviously be planned for utmost efficiency and, if they are to be adaptable, should retain that efficiency when adapted.

How far then can adaptability be designed into farm buildings? It is hardly possible to conceive a single farm building suitable for every use on the farm, and there are strong arguments in favour of putting up buildings designed specially for a single purpose. There could be a need, however, particularly on the smaller farm, for a building specially designed for adaptability, even to the extent of sacrificing some small loss in efficiency in one respect to gain it in another. On tenanted farms, the landlord might provide the basic general-purpose building, leaving the tenant to do the fitting out.

"Open" or "closed" plans

Most types of farm buildings can be roughly classified into one of two groups: the "open" building and the "closed". Both are often planned under the same roof, and it is advantageous to do so. In the "open" group are fodder barns, cattle yards and sheds for the storage of farm equipment and crops. "Closed" buildings are farm buildings where the control of environment within the building is important—buildings for intensive production of pigs and poultry for example. Other types of closed buildings are storage buildings providing complete protection from the weather for crops, feeding-stuffs and fertilizers.

So that the general-purpose building can meet the requirements of both these groups, its design must be a compromise in some respects. Generally it should consist of a wide span framed building in steel, timber or reinforced concrete, fitted out with the necessary equipment for the "open" requirements,

"closed" requirements being met by insulated linings on insulated sections within the main building.

A framed building is much more adaptable than the traditional type with load-bearing walls, as the infilling walls can be removed without the need to support the roof. The frame should be of a design that does not restrict the head-room within the building. A "portal" type of frame is very suitable for this, or if a roof truss is used, it should be of the type with a raised tie. This also has the advantage that doors in the centre of the gable enable the full height of the building to be used—for storing a combine for instance.

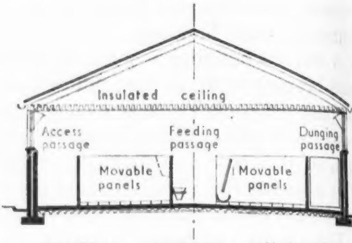
The length and span depend on the amount of accommodation required. The span should not be less than 27 ft and probably not more than 45. The eaves height has to be a compromise. A fodder barn, which is an "open" building, is usually round about 18 ft whereas a building for calves (a "closed" building) should be less than half this. It is obvious that both these heights cannot be provided under the same fixed roof, and it is considered that the eaves of a general-purpose building should be fixed at a height which is suitable for most purposes. Between 9 and 11 ft is suggested. A building of this height is satisfactory for loose housing and for general storage. It would not be too high for the installation of a ceiling, or lining the roof for insulation purposes, and the wall areas are not too extensive to make insulation or complete weatherproofing unduly costly. The cubic area of the building is not too much for an efficient ventilation system without draught. Insulated sections for livestock are practicable in a building of this height, as they are in a much higher building. A building round about 10 ft high is too low for the economic storage of bulk fodder, or to be adaptable for adult stock on some systems of slats, but in the wider span buildings with low eaves, sufficient height can be found at the centre of the building, leaving the areas adjoining the walls for purposes requiring more "closed" conditions.

Wall and floor construction

Infilling between the stanchions supporting the roof should be in brick or concrete to about half the height, clad up to the eaves level with galvanized iron, aluminium, timber or asbestos cement sheeting. The outside walls should be built strong enough for any purpose for which the building is to be used—for instance retaining muck or the thrust from stored potatoes. Nine-inch brickwork or the equivalent, bonded or tied in to the stanchions would normally be strong enough at the heights we are considering. Solid external walls are not completely waterproof, and if grain or fertilizer is to be stacked against the wall then cavity wall construction is recommended. An 11-inch cavity wall, if properly built, is as strong as a 9-inch wall in most respects and is not so much more costly; it is also a much better insulator against heat loss.

The floor of a general-purpose building should be of concrete not less than 4 inches thick, lightly tamped to make the floor non-slip and help the drain off. It is a good idea to incorporate a damp-proof membrane in the floor. Deciding on a system of drainage for the floor to suit several purposes is difficult, and again a compromise is necessary. A fall of about 1½ inches in 10 ft from the centre to each side of the building is probably the best way to do it, and would be suitable for most of the uses to which the building could be put.

Fitting out

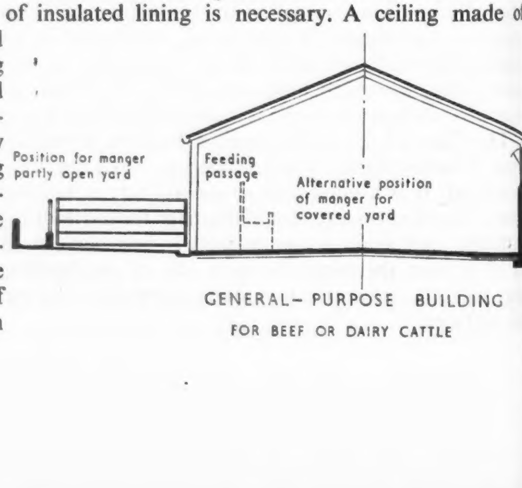


GENERAL- PURPOSE BUILDING

FOR CALVES | FOR PIGS

In a building up to about 30 ft wide, a fairly satisfactory system of lighting and ventilation can be achieved with a shallow hopper opening window in each bay of the building, but if positive air control is required then mechanical ventilation is necessary. In a larger building, it would be preferable to section off parts of the building into insulated chambers where the proper environmental conditions for livestock could be achieved with fan-assisted air flow. The best position for the doors into the building, for flexibility in use, is in the centre of the gable ends, and the openings should be wide enough and high enough to admit the normal farm implements.

Care in planning the layout in a building for general farm use is just as important as if the equipment were to be fixed permanently. Two methods of fastening the equipment to the floor are suggested. One is with tubes or light stanchions with fixed sockets in the floor; the other consists of threaded tubes built into the concrete floor, with steel holding-down bolts. When the bolts are not being used for holding fittings, they are greased and screwed tight back into the tubes, and do not offer any serious obstructions to the floor. There is a proprietary bolt and socket of this type on the market. The position and number of the bolts or sockets for posts depends on the layout of the building. In a 30 ft span building, bolts at $7\frac{1}{2}$ ft centres 4 ft from the wall and another line at 12 ft would cover a number of contingencies. In the larger building, a $7\frac{1}{2}$ ft grid would be satisfactory, though probably only in areas scheduled for "closed" conditions. Panels for pen walls could be made of solid or slotted metal angle with infilling panels of standard sheets of corrugated steel or plywood, or any other durable sheeting. The bottom angle of the panel frame bolted to the floor, and sections bolted one to another, would form pens suitable for pigs, calves or young stock, or bunkers for the storage of grain in bulk. Feeding barriers, cribs and food bunkers could be made up in the same way and fitted as shown in the lower drawing on this page. When insulation against heat loss is needed in the building, some form of insulated lining is necessary. A ceiling made of bitumen paper covered with an insulating quilt or fill, and carried on wire netting hung by catenary wires from the building frame is one possibility, and would be inexpensive to provide. Alternatively, the underside of the roof could be lined with



GENERAL- PURPOSE BUILDING

FOR BEEF OR DAIRY CATTLE

insulating board and vapour seal. A roof cover of the sandwich type incorporating an insulated layer is worth considering for the basic building. On the floor, hollow tile partition blocks could be laid in the pen areas, or slats retained in position by the pen sides. If the clay blocks are a good sample there is no need to cover them with a wearing surface of concrete.

Basically, the general-purpose building is no more than the standard type which is found on many of our farms. Careful planning is needed in the fitting out, both from the point of view of layout and construction of the fittings. In a short article such as this it is not possible to go into very much detail, but the scope of development of this type of construction on the farm could well be quite extensive.

Agricultural Chemicals Approval Scheme

Additions to the 1961 List of Approved Products

THE following additional products have been approved under the Agricultural Chemicals Approval Scheme since the first List of Approved Products was published on 1st February, 1961. The basic List is available, free, from the Ministry (Publications), Ruskin Avenue, Kew, Richmond, Surrey, and from all Regional and Divisional Offices.

INSECTICIDES

AZOBENZENE SMOKES

Murfume Azobenzene Smoke—Murphy Chemical Co. Ltd.

DERRIS SPRAYS

Murphy Liquid Derris—Murphy Chemical Co. Ltd.

"KELTHANE"/DIAZINON ATOMISING SOLUTIONS

Kelthane Plus Atomising Concentrate—Murphy Chemical Co. Ltd.

LEAD ARSENATE POWDERS

Murphy Arsenate Lead Powder—Murphy Chemical Co. Ltd.

MORPHOTHION EMULSIONS AND MISCIBLE LIQUIDS

Murfly H—Murphy Chemical Co. Ltd.

SCHRADAN MISCIBLE LIQUIDS

Brussels Sytam—Murphy Chemical Co. Ltd.

FUNGICIDES

MANEB WETTABLE POWDERS

American Dithane—Pan Britannica Industries Ltd.

NABAM

Dithane D.14 and Zinc Sulphate—Pan Britannica Industries Ltd.

Bulk Storage and Handling

One of the few near certainties in agriculture today is the continuing drift of labour from the farm to other employment. Thus there is a growing need to make better use of a labour force which is becoming increasingly skilled and expensive, and machines will tend progressively to replace labour. The machines themselves are bound to become more complicated and expensive, and in operating them workers will have to face greater responsibility. As a consequence they will need to be trained and treated accordingly. It will not be possible or practical to use expensive pairs of hands merely for the tasks of packing or unpacking, nor to use the workers themselves as beasts of burden. This is one good reason for thinking again about bulk storage and handling of agricultural materials and produce and its effect upon our buildings.

But the mechanization and automation which bulk storage implies will not reduce the demands on the farmer's managerial capacity. On the contrary, these demands will certainly grow much heavier as the art in husbandry slowly disappears before the precision and accuracy of science and engineering.

Equally, the landowner and land agent will find increasing need for highly developed managerial ability. In an age of progress, flexibility of capital investment in the form of buildings and farm layout and equipment will make relationships with tenants closer than ever.

Obsolescent buildings will be an increasing problem. For the owner-occupier particularly, this will mean finding capital for buildings of a more adaptable character.

Flexibility of capital assets presupposes the use of simpler and more adaptable buildings—it may soon force upon owners an entirely new approach to the problem of equipping a farm for the future. Fortunately bulk storage usually demands less complicated buildings.

Farming today is big business, and on the farm as a whole methods have got to be found which will produce food of better quality to a consistent standard and at lower cost.

This will mean greater reliance on farm management as a science. One result of this will be simplified cropping and stocking systems to reduce overhead costs, which will not only reduce the variety of products and materials used but substantially increase the quantities of those that are produced.

Bulk storage and handling of the raw materials or products of farming is one way in which some of the costs can be reduced, and some of the building problems eased. Packing and unpacking and handling in small quantities add little or nothing to the value of materials used on the farm; and they rarely add to the value of those sold off it.

But mechanization or automation with bulk methods is a matter of long-term policy. Unless this policy is sound it can result in fundamental and expensive mistakes in the farming system. Similarly, continuing development of the science of farming means continuing adjustment of the organization

of the farm. Whilst this implies increasing demands on farm management skill, it also means that considerably more thought will have to be given to layout, not only of the farmstead but also of the farm itself.

For the farmer, the decision whether or not to go in for bulk storage and handling does not depend solely on possible savings in labour; it depends also on the economic policy of the farm and the economics and techniques of the particular enterprise concerned.

For the owner, his attitude to his tenant's decision will be influenced by the amount of capital available for reconstruction and re-equipment, and whether the building to contain the new method will show a long-term advantage. He may also have to consider whether the introduction of new capital is justified on estate management grounds.

There may be cases where sound estate management will best be achieved by amalgamating holdings, thereby making better use of the owner's capital investment in buildings.

At the same time, because we live in an age of quickly changing ideas, methods and techniques, flexibility in the design and use of buildings is important. To achieve flexibility for bulk storage is fairly simple so far as design is concerned. But there can be many hidden snags in the detailed constructional techniques. For example, an ordinary concrete floor may be admirable for grain in bulk but it can quickly be ruined if it is used for bulk fertilizers—or even for careless storage of fertilizers in bags.

Equally, it is easy to decide upon and build a bin storage system for grain. This can be wasteful. There are times when different types of qualities or conditions of grain must not be mixed. If as a consequence there is vacant space, no other use can be made of it. Similarly, unless bulk sales and delivery are possible, the labour-saving advantages of the system can quickly be lost.

When it comes to stockfeeds, bulk storage and handling have a much wider role. Not only are physical effort and vermin damage reduced; the work of milling and mixing and of distribution to the stock is considerably lightened. But bulk handling and feeding methods demand much more care and control than the use of that handy rationing pack, the 56 lb bag. This is because even though the process begins with a large bulk, small quantities still have to be rationed out to the stock. Unless this is done carefully and accurately any financial advantages are soon lost. Again, the larger the variety of feeds the more difficult, expensive or complex the arrangements which have to be made to store and feed them.

Skilled farm management usually means fewer but more productive enterprises on an individual farm, and in turn it leads to simpler, more flexible buildings. The search for simplicity will also lead to bulk storage and handling of at least some of the farm's products and necessities.

If there is a moral in all this it must surely be that owners must be alert to the rapidly changing requirements which their buildings have to meet. Making plans for new buildings and new layouts of buildings calls for deep thinking and for close consultation with tenants and properly qualified farm building designers.

L. M. PARSONS

Farming Cameo: Series 2

38. Haltwhistle, Northumberland

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District Advisory Officer

THE Haltwhistle district is in the south west of the county, and is bisected by the upper valley of the South Tyne. It is bounded to the west by Cumberland, to the south by Co. Durham, to the east by the area known locally as Hexhamshire, and to the north by Kielder Forest.

The chief feature of historical interest is Hadrian's Wall, which traverses the district on the north side of the Tyne from Haydon Bridge in the east to Gilsland in the west. The Wall is a Mecca for archaeologists, and every summer tourists from all over the world come to see it, to visit Housesteads Camp—one of the original Roman encampments—and inspect the local museum. Farmers along the Wall, however, do not entirely share the tourists' enthusiasm for the traces of Roman civilization, being more concerned with keeping field gates closed, and, as the area is scheduled as a National Park, in negotiations with the Planning Authority for the erection of new buildings, etc.!

To the south of the Tyne valley and running at right angles to it are three parallel Dales—East and West Allendale and Knaresdale. Each is about 10 miles long, and they lie at the extreme northern end of the Pennine Chain. The land between them rises to well over 1,000 feet and is mostly open common used exclusively for sheep grazing. The largest of these areas is known as Allendale Common, and extends to some 50,000 acres.

The system of stocking this open common is interesting. Originally, each farmer having a right to graze sheep on the common was awarded a certain number of "stints", a stint being the right to graze 5 ewes, so that, to be precise, the area is not a common at all, but a stinted pasture. The stint holders appoint a stint herd, who is responsible for seeing that no overstocking occurs. Stints may be let or sold outright, so that some farms now have a large number and others have none. Ewes grazed under these conditions have an acclimatization value as they are "hefted" to their own stretch of the common, and the buying-in of other ewes involves an enormous amount of shepherding. There has long been a move afoot to fence and reapportion the common, but there are many difficulties still to be overcome.

Annual rainfall varies from 35 to over 60 inches on the high fells, and altitude from 300 feet in the Tyne Valley to over 2,000 feet.

The soils are a geologist's paradise. Most of them are drifts of glacial origin, mainly overlying limestone with large pockets of Millstone Grit. Several local outcrops of limestone provide local lime quarries. Numerous outcrops of Carboniferous rocks have in the past provided small amounts of coal worked from local drifts, but the majority of these are now closed. The Roman Wall itself is built on a Whin Sill, while the valley bottoms are alluvial.

Under these conditions of soil, rainfall and topography, arable farming has little place. Oats is the only cereal grown, and this on a limited scale.

Grass predominates, and of a total of 119,000 acres, 72,000 are classified as rough grazings. Of the total number of farms, about one-half are dairy holdings and the others livestock rearing farms.

The dairy farms are of the typical Dales type, and are indeed situated in the three Dales already mentioned, the much larger sheep and cattle rearing farms being along the Roman Wall.

In the Dales the average size of holding is only about 45 acres. Although the income of these farms is derived from dairying, many of them are not well suited to this system due to limitations of land and buildings.

The history of these holdings dates back several hundred years to the time when the Dales were thickly populated and the lead and silver mines were a thriving industry. They were then occupied by the miners, who farmed them purely as a sideline. Now that lead mining has become unprofitable they are being farmed as full-time holdings. There is a continuing move towards amalgamation, but this is a slow process, and in many instances farmers are being forced by economic difficulties to look for part-time work.

The Small Farmers' Scheme found many of these holdings eligible, and the majority of the farmers have not been slow to avail themselves of the various grants obtainable. During the last five years or so, silage-making has caught on surprisingly well and now covered, barn-type silos are common. Where possible, Italian ryegrass is grown for early bite, but there are many holdings where the physical nature of the land precludes use of the plough. Strip grazing with an electric fence is now standard practice. Drainage is often a headache, many of the existing tile schemes being obsolete.

Stock consists in the main of Northern Dairy Shorthorn herds, although recently there has been a marked swing towards Friesian. A.I. is used fairly extensively and there is still a tendency towards rearing all heifer calves. Ewes are Swaledales, crossed with a Hexham Leicester ram to give Greyface lambs.

The rearing farms along the Roman Wall are much larger, many of them running to over 1,000 acres. They carry Blackface ewe flocks, crossed with the Hexham Leicester ram to give Mule lambs, and single-suckler herds of Galloway and Shorthorn × Galloway cows put to a Galloway bull to give suckler calves, which have been commanding good prices at the autumn sales. On some Galloway herds a White Shorthorn bull is used to give the locally famous "Blue-grey", a cross in keen demand on the fattening farms.

Most of the farms have benefited under the Livestock Rearing Act Schemes; farmhouses have been modernized, buildings renovated, electricity and water supplies provided and access roads improved.

Hypomagnesaemia has been troublesome among these suckler herds in recent years, but the main problem is lack of sufficient in-bye ground to provide enough winter fodder. The practice of feeding concentrates to hill ewes is increasing rapidly.

Industry has made no inroads into this district, nor is this ever likely. Even at Hexham, the main market town for the area, the emphasis is on the two livestock marts, through which thousands of head of stock are sold annually.

At the Farmers' Club

The Rt. Hon. Christopher Soames, C.B.E., M.P.

Minister of Agriculture, Fisheries and Food

"WHAT I want to do today" said Mr. Soames in his address to the Farmers' Club on 10th May, "is to discuss with you what seem to me to be the main problems in agricultural policy for the *future*".

During and immediately after the last war, our main task was to produce all we could, but now the chief object is to sell all we can. This problem is not peculiar to agriculture. All other progressive industries bend very considerable resources towards solving it, and every industry, as a matter of course, adjusts its output to its sales. Marketing is not a dirty word, and to sell may become even more important than to produce.

"We want a strong and vigorous agriculture. But the best way to secure its strength and vigour is to concentrate more effort on disposing of its production and disposing of it profitably." First we must increase sales and find new markets in this country. The Government should help to create conditions in which changes can be made, but the industry must work out the ways of achieving its objectives.

It is fundamental to our present system of agricultural support that much of our home-grown produce must sell at the world price with a deficiency payment added. Some people believe, declared Mr. Soames, that the Government should protect home agriculture by different means: by resolutely keeping the foreigner out, through total prohibition, a quota or a considerable tariff. But it would be unreasonable to expect support through one system which makes the consumer pay and, at the same time, through another which finds funds out of the Exchequer. We cannot have it both ways.

Another kind of critic asks why, for example, does the Government let cheap Russian barley into the country, when it lowers the home producers' price and increases the amount the Government has to find in deficiency payments? Mr. Soames answered that in many ways we benefit from the low prices—for example through cheaper compound feedingstuffs—and in any case we are buying at world prices, which are largely determined by the amount of barley on offer throughout the world.

This leads to a point of great relevance to the handling of future problems. With the soaring increase in agricultural production and yields of recent years, the prospect is one of ever-increasing surpluses of food in many countries, which may strain our present system of support severely. Inevitably, we shall tend to be the market to which a large part of these surpluses will be sold.

"Now, to add to the problem, we have the agricultural plan of the Six. If that succeeds, the Six will surely become more self-sufficient. As they reach this position, our problem will be aggravated, in so far as they will be importing less and possibly exporting more. We are going to face a changing situation. The one mistake we cannot afford to make it to take up fixed positions beforehand and be too rigid in our mentality."

We must devote at least as much attention to marketing as to production, the more especially as we move into a period of world surpluses, and perhaps of some national surpluses.

We should aim at three objectives:

1. To find better ways of presenting and selling our produce to meet the needs of the market;
2. To concentrate on those lines which offer the greatest scope, and
3. To gear our production to a profitable output.

To attain the first of these, the industry must woo the market. The Milk Marketing Boards, the milk distributors and the Egg Board have boosted consumption profitably, and what has been done for milk and eggs can and should be done for other commodities, given the same kind of joint effort between distributors and producers.

But first "you have got to find out what the market wants, and make sure that what you are putting on offer is reasonably uniform in quality and meets the requirements of the customer". This market research is basic. "I am bound to say", added the Minister, "that I was disappointed that the Unions were not able to accept the Government's offer of a payment of £½m. in each of the next three years to prime the pump for such an effort, because I am quite certain that this is one of the directions in which the greatest progress must be made."

Then there is the problem of how to prevent producers' returns from being endangered by a catastrophic fall in prices. Low world prices, such as prevail for barley, must influence the price of home-grown grain. But we need not make matters worse by putting too much of the home crop on the market all at once. The Minister expressed the belief that the new guarantee arrangements for barley will check the present tendency for this to happen. He hoped, too, that the Government's plan to enable the Potato Marketing Board to deal with recurrent surpluses, which have sometimes ruined growers in the past, will be acceptable and beneficial.

Turning to the second aim—that of concentrating on lines which offer the greatest scope—Mr. Soames said: "It is, I think, a proper function of Government to say when and where there is scope for expansion, and equally to say when further expansion may be unprofitable and undesirable." He cited what was done in the Price Review about beef, pigs and milk; in particular, he emphasized that some solution must be found of the milk production problem. "It would be disastrous if producers were to continue in the illusion that the remedy for falling returns caused by ever-rising production is to increase production still further."

Lastly there is the third objective: to gear production to a profitable output. There is of course no fixed, optimum level of output: the aim must be to produce and sell profitably more all the time. But, said the Minister, "the industry is entitled to a reasonable assurance that, barring unforeseen disaster, it can rely on a certain degree of stability. I hope that what we have done, both for beef and for pigs, is an earnest of the Government's awareness of this".

A. M. RICHARDSON

THE MINISTRY'S PUBLICATIONS

Since the list published in the May 1961 number of AGRICULTURE (p. 107) the following publications have been issued.

MAJOR PUBLICATIONS

Copies are obtainable from Government Bookshops (addresses on p. 170) or through any bookseller at the price quoted.

BULLETINS

No. 167. Cattle of Britain. (Revised) 6*s.* (by post 6*s.* 4*d.*)

A guide to the qualities which British Cattle offer, whether for meat or milk, or both, over a wide range of environmental conditions.

OTHER PUBLICATIONS

Experimental Husbandry No. 6. (New) 5*s.* (by post 6*s.*)

Contents include: Experiments with salt and potash on sugar beet in S.E. Scotland; ploughing down fertilizer for sugar beet; rearing calves on a reduced quantity of whole milk; free choice feeding for laying hens; experiments on restored opencast coal sites.

Experimental Horticulture No. 4. (New) 5*s.* (by post 5*s.* 5*d.*)

Discusses home production of early potato seed; onion production from sets; trapping of bullfinches; a study of shelter belts; field temperatures and the forcing of rhubarb.

The Mites of Stored Food. (New) Technical Bulletin No. 9. 17*s.* 6*d.* (by post 18*s.* 2*d.*)

Brings up-to-date our knowledge of the systematics and biology of the storage mites. Keys, descriptions and illustrations which are included will enable the worker who has mastered the principles in the first chapter to proceed to identification by means of the keys in the later chapters. Illustrated. Fully bound.

Smallholdings Organised on the Basis of Centralised Services. (New) 2*s.* 6*d.* (by post 2*s.* 10*d.*)

Report and accounts for the year 1959-60. Submitted by the Land Settlement Association Limited.

LEAFLETS

Up to six single copies of Advisory Leaflets may be obtained free on application to the Ministry (Publications), Ruskin Avenue, Kew, Richmond, Surrey. Copies beyond this limit must be purchased from Government Bookshops, price 3d. each (by post 5d.)

ADVISORY LEAFLETS

No. 297. Sweet Corn. (Revised)
No. 377. The Pollination of Apples and Pears. (Revised)
No. 493. Methods of Feeding Silage. (New)

FREE ISSUES

Obtainable only from the Ministry (Publications) Ruskin Avenue, Kew, Richmond, Surrey.

Poultry Stock Improvement Plan. Register of Accredited Poultry Breeding Stations, Accredited Hatcheries, Approved Hatcheries and Standard Bred Breeders (Revised).

FARM SAFETY LEAFLETS

Stationary Threshers and Balers (Welsh Version)
Lifting and Carrying
Code of Practice for Ground Spraying

In Brief

BLEDISLOE VETERINARY AWARD

For his work on the eradication of bovine tuberculosis, Sir John Ritchie, C.B., F.R.C.V.S., F.R.S.E., Chief Veterinary Officer of the Ministry of Agriculture, Fisheries and Food, is to be the first recipient of the Bledisloe Veterinary Award and Medal—a fitting choice following the year that the whole country became Attested.

The Award made to Sir John is also in keeping with the object for which the late Lord Bledisloe originally presented the Trophy. It was given between 1946-57 to the county adjudged to have made the best progress in the eradication of tuberculosis in dairy cattle. This purpose having been accomplished, the cup is being re-presented in 1961 for outstanding individual achievement in the veterinary field.

The Bledisloe Award is not being made annually, but only from time to time in respect of some particularly meritorious piece of work or achievement in veterinary science or practice.

MONEY UNDER THE HEDGE

An offset single-furrow plough is adding acres to Boots' Farms, Thurgarton, Nottingham, by reaching right under hedges. It also provides better surface drainage for the heavy clay soil and prevents the spread of crop-smothering twitch from hedge bottoms. Two extra 9-inch furrows along four sides of a square 10-acre field grow an extra 2¾ cwt of cereals where yields are 30 cwt per acre. If wheat, the extra cash value is £3 10*s.*—and the offset plough often gains three furrows, not just two.

With traditional ploughing, the surface drainage provided by open furrows across the field rarely finds an outlet over the headlands. And more soil is thrown under the hedge in "ploughing out" than is brought back by "ploughing in" in alternate years. The result is that water often stagnates in headland hollows to the encouragement of water grasses and twitch and to the detriment of crops.

Re-contouring of fields is being achieved at Thurgarton by round and round ploughing finished by scouring out hedge bottoms with the offset plough.

INDOOR STORAGE OF POTATOES

The first apparent advantage of storing potatoes indoors is the independence from weather conditions for grading and bagging off. Of much greater importance, however, is the opportunity afforded for ventilation and temperature control to deal more effectively with sweetening and sprouting by comparison with clamped potatoes. Against this, there is a greater weight loss and more responsibility in management.

Potatoes can be stored satisfactorily until the end of March, but by that time the weight loss may be as much as 3 per cent or, in extreme cases, as much as 5 per cent of the original weight stored, mostly because of sprouting. Research has found an answer in the use of nonanol, a liquid chemical which can be vapourized and blown through a stack of potatoes by way of the ducting, to act as an inhibitor when sprouting begins. This provides a second use for ducting; to fulfil its primary purpose of ventilating the stack efficiently, a cross sectional area of 2 sq. inches per ton should be allowed.

Fundamentally, the requirements of successful bulk storage are simple; exclusion of rain, surface water, frost and light, and provision for the removal of excess heat generated by the potatoes themselves. The maximum economic stack height is found to be 12 feet; it is governed by the physical difficulties of loading, the dangers

of overheating and the cost of erecting walls of adequate strength. In theory, there is no limit to the width of a store, but in practice from 24 to 36 feet is found to be most satisfactory as the clear working space required to begin grading can then be economically provided. In very wide stores the cost of this amenity could become prohibitive.

Horizontal pressure, although not as great as vertical pressure, is considerable, and will vary according to the height of the stack and the variety and cleanness of the potatoes. Calculations for reinforcing the walls should be based on the storing of thoroughly matured potatoes free from soil, weighing 40 lb per cu. foot, which would give an angle of repose of about 35 degrees, but expert advice should be sought.

The store should be sited on land free from flooding, and should be in the centre of the area which it is to serve, with good access and room to manoeuvre vehicles in and out. In stores of under 100 tons capacity, one door is usually adequate, with 11 feet clear headroom if tipping trailers are to be used. Above this capacity another door is desirable at the opposite end of the store, and in even larger stores side access doors should also be provided.

The specially designed building with its insulated lining can cost as much as £12 per ton stored. On the other hand an existing building may be converted for no more than the cost of ducting and lining with straw bales. Between these extremes a comparatively cheap store is being developed which fulfils the basic requirements of excluding the elements and also has the advantage of being easily adapted to some other purpose. It consists of a portal frame of steel or concrete; the infilling walls are formed of straw bales retained by a stoutly constructed post and rail fence. The straw bales provide the insulation and in most situations would be weatherproof, though on exposed sites it may be necessary to line them with building paper or plastic sheets to exclude moisture and draughts. In all types of indoor stores the stacks must be covered with straw, to exclude light and take up the moisture produced by condensation.

R.A.S.E. RESEARCH MEDAL

In recognition of his work on virus yellows and other diseases of sugar beet, the R.A.S.E. Research Medal for 1961 has been awarded to Dr. Raymond Hull, Head of the Rothamstead Field Station at Dunholme, Lincolnshire. This is the seventh award of the medal which can be given annually for agricultural research work of outstanding merit undertaken in the United Kingdom. The Medal carries with it a prize of 100 guineas. Past recipients include Dr. R. L. Wain, Professor of Agricultural Chemistry at Wye College; Dr. Alan Robertson of the Institute of Animal Genetics, Edinburgh; and the late Dr. Arthur Walton of the Animal Research Station, Cambridge.

Dr. Hull has been working on sugar beet diseases since 1935 and is rightly regarded as the world authority on the subject. He has contributed much to knowledge about the incidence, methods of spread and methods of controlling many of the pests and diseases, but his contributions on virus yellows, potentially the most serious disease of sugar beet in the United Kingdom and throughout Western Europe, are outstanding for the benefits they have conferred. That it now causes only moderate losses here is a direct consequence of his research.

THE NEW APPRENTICESHIP SCHEME IN AGRICULTURE

Changes are announced by the N.F.U. which will make the Agricultural Apprenticeship Scheme more attractive both to potential employers and to young people entering the agricultural industry. The new scheme brings agriculture into line with apprenticeship in other industries, so that although the young worker suffers financially during the apprenticeship period he gains the material reward of his labour thereafter.

Its aim is two-fold: (1) to end the feeling that there is no incentive for country boys, including the sons of farm workers, to enter the industry via the Training Scheme; and (2) by authorizing an abatement of wages during training to recompense, in some measure, employers who undertake the task of training and allow their trainees paid release for technical classes, often at considerable inconvenience in the case of small farms.

The decision to make the premium wage rates conditional on a youngster gaining Proficiency Certificates has been taken in his own interests. To date there has been no system of testing practical knowledge and ability of any apprentice.

Under the Agricultural Apprenticeship Council's new formula, apprentices will be placed as far as possible on the type of farm of their own choice, so that their training will be mainly in the branch of farming in which they have most interest. But it is the Council's intention that apprentices shall nevertheless, as far as possible, receive a good general grounding in all farm jobs.

The six categories of farm work from which an apprentice can choose are: Cowman; Stockman; Shepherd; Pigman; Poultryman; Farm Machinery Operator. In horticulture there are five: Fruit-growing; Nursery Practice; Glasshouse Practice; Intensive Market Gardening and Extensive Market Gardening. Under the new scheme the minimum amount of day release time for technical training will be increased from 35 days to 60 days. This will be spread over the full three-year period in order to minimize interference with farm routine.

Apprentices will be awarded Apprenticeship Completion Certificates without any formal technical examination. The only requirement is that the Apprenticeship Council, through its District Committees, should be satisfied that the apprentice has diligently covered the appropriate course of technical instruction.

This scheme is being devised against a background of the growing realization in Europe of the need for really skilled farm workers. (In West Germany alone there were no fewer than 43,000 three-year agricultural apprentices in 1957.)

The Council intends that through the training given, farmers will be able to rely on the ability and efficiency of ex-apprentices. From the farm workers' point of view, while the Council cannot guarantee that the ex-apprentice will be able to find employment at the premium rate, it has sufficient faith in the scheme to believe that employers will be willing to pay for proved ability.

Details about the proficiency tests and new wage rates can be obtained from the National Farmers' Union, Agriculture House, Knightsbridge, London, S.W.1.

SAFE DISPOSAL OF CONTAINERS

Careless storage or disposal of containers of toxic agricultural chemicals can lead to accidents. A leaking container improperly stored can contaminate feedingstuffs and so poison animals. Children may find a used container, not washed out and left lying in a hedge, and its contents may harm them.

Always observe these simple rules:

1. When a spray is being prepared, rinse out containers immediately after emptying them and pour the rinsings into the spray-tank with the spray preparation.
2. Burn all the non-returnable containers you can, and puncture and bury those which will not burn. Returnable containers should be sent back as soon as possible.
3. Store full and partly full containers securely, well away from the farm living area and any feedingstuffs, and out of reach of children or animals.

Book Reviews

The Biology of Weeds. British Ecological Society Symposium No. 1. Edited by J. L. Harper. Blackwell Scientific Publications. 42*s*.

This book contains 25 papers presented at a symposium held at Oxford in April, 1960; no discussions are reported. Individual papers vary considerably both in style and treatment of subject matter. Four papers on the taxonomy of weeds are strictly for botanists. Four deal with overseas weed problems. Several of the rest, however, have practical farming implications.

Dr. Joan Thurston of Rothamsted has contributed a lucid account of dormancy in weed seeds, with special reference to the problem of controlling wild oats. Two papers from the official Seed Testing Station, Cambridge, deal with measures to prevent dissemination of weeds by crop seeds, and the complementary question of how to control and eradicate weeds in seed crops.

The success of legislation in reducing weed dissemination seems to depend on an adequate supply of crop seed low in weed seed content, to allow the buyer to exercise a choice. Further improvement will depend on wider production of seed crops free from the weeds that commonly contaminate the seed. This in turn will depend on the adoption of husbandry techniques to eliminate the weeds at the most appropriate stage, based on a deeper knowledge of the relationship between the life cycles of weeds and crop. An interesting account is given of experimental work designed to study the various factors involved in producing a herbage seed crop from twelve acres of very weedy heavy land.

Theoretical studies at Oxford on weed populations reaffirm the wisdom of applying control measures early, before weeds become firmly established. Once a weed infestation attains a population density such that self-regulation of seed output occurs, it has enormous resilience to change.

The National Vegetable Research Station's work on weed competition in vegetable crops is reviewed mainly from the point of view of research techniques, but two practical points emerge. The spatial arrangement of vegetable crops has considerable influence on yield, and absence of weeds during early growth is particularly important. Pre-emergence herbicides with some residual effects would therefore seem likely to be more beneficial than those applied after crop emergence.

S.L.

The Thatcher's Craft. Rural Industries Bureau. 42*s*.

Thatching, from being the poor man's necessity, has become a luxury of the well-to-do. While farm workers settle down contentedly in brick-and-tile council houses, revelling in the new-found amenities of a bathroom, constant hot water and a built-in kitchen unit, their vacated cottages are eagerly snapped up by solicitors, scientists, colonels and accountants who have money they are prepared to spend on the derelict antiques. This is just as well, for if thatch had to hold its own nowadays on a purely commercial basis it would soon become a lost craft, a fate which, indeed, the pessimists were forecasting for it a couple of decades ago.

Even when thatching was overwhelmingly utilitarian, the competent thatcher managed to develop it as an art. There is always joy to be found in shaping any natural material to one's will, and an expert thatcher could transform even a mangold clamp into an object pleasing to the eye. Now his talents are given far greater scope than he could ever hope to find on barns and haystacks.

A measure of the popularity and prosperity of his craft in the 1960s is to be found in this mangificently produced and profusely illustrated volume. Indeed, much the greater part of the book is made up of illustrations. There is a competent text on the story, the materials and the tools of thatching, but page after page is filled with superb photographs depicting in detail the finer points of the craft. We are shown how to thatch around a chimney, how to lay a ridge-course, how to split a spar, how to make those lovely criss-cross patterns with

spars, how to trim around those attractive little dormer windows which peep out of so many thatched roofs. I have made a rough job of thatching a rick once or twice, but with this book as a guide I think I could undertake to thatch a house.

It is good to know that the modern artists in straw and reed can command a reasonable reward for their skill. Complete to the last detail, this book even advises them how much to charge! *R.W.*

Field Drainage. M. C. LIVESLEY. Spon. 37*s.* 6*d.*

In recent years there have been remarkably few books by British authors on the subject of field drainage. This may be due to the fact that likely authors have been too busy draining the land and making good the neglect of former years, or because having started to write, the author has been overawed by the complexity of the subject and the difficulty of explaining it simply. Mr. Liversley is to be congratulated on finding both time and the courage to set down his ideas.

As an attempt by the author to present his own views on this subject the book is both interesting and instructive, and the accounts of his experiences in putting in drainage schemes and the difficulties he has encountered and overcome are excellent. But as an authoritative text-book on field drainage it leaves much to be desired.

After an opening chapter on the history of field drainage, the next four chapters deal with its purpose, benefits, underground water movement, and soils and systems. The science of drainage is not yet fully understood, even by those doing the research work. It is not surprising, therefore, that in trying to explain field-drainage in simple language the author, although a sound practical man, should find himself out of his depth, and should reach conclusions or give explanations which are unlikely to be accepted scientifically, It is a pity that these personal ideas should be stated as facts and not clearly as the author's views. The chapters are inclined to be repetitive and in some places give the impression that the author has an axe to grind about the ill-effects of badly timed and poor cultivations.

In the remaining chapters. which deal with the more practical aspects of design and installation of drainage systems, Mr. Livesley is obviously on more familiar ground, and the views expressed are less open to criticism. Whilst drainage remains more of an art than an exact science, the knowledge must be built up largely on practice, and for this reason these chapters, based on the author's own experience, are very useful.

The book is very readable but it is unfortunate that Mr. Livesley has spent so much space in trying to explain the "how" and "why" of drainage instead of writing about more of his own practical experiences.

G.H.T.

The Agricultural History Review. (Volume VIII. Part 2. 1960.) Edited by H. P. R. FINBERG. The British Agricultural History Society. 12*s.* 6*d.*

The authors of the main articles in this issue include an ecologist, a geographer and an agricultural economist as well as two historians. Together they illustrate the variety of disciplines needed for the proper study of our agricultural past, even as their articles illustrate the variety of problems awaiting investigation. In sixty pages we range from the forgotten hand-cultivators of the Chalk downs, via the settlement of the Welsh borderland to seventeenth century Yorkshire, with glances at Scottish rural records, the open field system and mediaeval statistics on the way.

The last dozen pages are even wider in scope. Among the books reviewed are a history of the brewing industry, a Dutch history of European agriculture, an American history of the agrarian origins of modern Japan and a history, "with a gorgeous frontispiece in full colour", of the traction engine. And here perhaps is a criticism. There can be no complaint about the quality or the interest of the articles; indeed, the contributions of Dr. Thomas and Mr. Harwood Long are models of the use of evidence, in one case physical, in the other documentary, to produce conclusions. But none of the articles are primarily "technical" in character, whereas a third of the books reviewed—those on brewing, cheesemaking, traction engines and the Cockle Park experiments—are presumably

on mainly technical themes. Readers concerned with the scientific and engineering aspects of modern farming will certainly benefit from reading all the articles in this *Review*. But they would surely appreciate a few more on the development of agricultural technology.

N.H.

The Lily Year Book 1961. The Royal Horticultural Society, 12*s.* 6*d.*

This year's publication of the *Lily Year Book (No. 24)* is dedicated to Sir Eric Savill, who has done much to encourage the growing of lilies at the Savill Gardens, Windsor. In many ways its presentation is similar to that of the *Narcissus and Tulip Year Book*, but in other respects it covers a much wider field, for it not only includes lilies and fritillaries, but also other allied genera belonging to the *Liliaceae* as well.

Several chapters deal with the various aspects of lily growing in countries as far apart as New Zealand, Australia, Finland and N. America, while at home Sir Frederick Stern, who grows lilies so well on a chalky soil, gives a summary of some of the new named hybrids and seedlings which he has grown in his garden during the past year. This should be a guide to the types of lilies to grow, and an encouragement to those who garden on a similar soil. Another article of note by Mr. D. Foxwell gives a very detailed account of the successful growing of lilies without soil, on a large commercial scale, under glass.

The genus *Fritillaria* is dealt with by Messrs. J. Newall of Bayfordbury and W. G. Knox-Findlay of Keillour Castle, who discuss the species they can grow best. There are many other notes relating to the successful cultivation of these very beautiful and fascinating plants. And last but not least a very comprehensive chapter on the genus *Scilla* by Messrs. E. B. Anderson and P. M. Synge, who describe all the species in cultivation at the present time, as well as giving their distribution and cultural requirements. It certainly makes a welcome addition to the *Liliaceae*.

The Royal Horticultural Society are again to be congratulated on producing work of a very high standard, containing several first-class coloured plates and many excellent black and white photographs which greatly enhance the value of the publication.

G.H.P.

The Vegetable Garden Displayed. Royal Horticultural Society

A new, enlarged and completely revised edition of this most useful and richly illustrated book has just been published by Geoffrey Bles, paperback 6*s.* boards 10*s.* 6*d.*

Printed in England under the authority of HER MAJESTY'S STATIONERY OFFICE
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OFFICIAL APPOINTMENTS

THE GOVERNMENT OF NORTHERN NIGERIA

requires

AGRICULTURAL OFFICERS

on favourable contract terms

Qualifications: Candidates must have a Degree in Agriculture, Horticulture or Natural Science, and not less than two years approved post-graduate training or experience. Post-graduate training at Cambridge or Trinidad is normally required, but appropriate post-graduate experience may be accepted in lieu, in whole or in part.

Duties: Investigational work with crops, livestock and farming systems, training of field staff and all aspects of agricultural extension work.

Emoluments: 1. *Salary* depends on qualifications and experience ranging from £972 to £2046 per annum.

2. *Outfit Allowance* of £45 and Camp Equipment Allowance of £40 on first appointment.

3. *Resettlement Grant* of £25 or £37 10*s*. for each three months service, inclusive of earned leave, payable on satisfactory completion of contract.

4. *Children's Allowance:* £120 for one child, £216 for two and £288 for three children eligible, up to the age of eighteen years.

5. *Free Passages* for officer and wife on appointment and on leave, and assistance towards cost of children's passages.

Leave: Generous home leave on full pay.

Applicants should write to:

The Recruitment Secretary, (Overseas), Northern Region Recruiting Agency, Nigeria House, 9 Northumberland Avenue, London, W.C.2.

or telephone TRAfalgar 1244, Extension 145.

FEDERAL GOVERNMENT OF NIGERIA

SPECIALIST OFFICER

(PLANT BREEDER)

REQUIRED by the Federal Department of Agricultural Research, Moor Plantation, Ibadan, to carry out research on plant breeding with special reference to Kola.

Candidates must possess a University Degree in Natural Science (Botany) or Applied Science (Agricultural Botany) with First or Second Class Honours, plus two years post-graduate experience or training in Plant Breeding. Candidates should be between the ages of 22 and 30 years. The post is not open to women candidates.

Appointment on contract for two tours of 18-24 months in the first instance with prospect of extension. Salary according to qualifications and experience in the scale £1,404—£2,196 per annum (including Inducement Addition). Gratuity of £150 per annum on satisfactory completion of tour. Outfit allowance of £60 on salaries under £1,741. Free passages for officer and wife. Children's allowances while separated. Liberal home leave on full pay. Income tax at low local rates. Quarters at low rent.

Write for application forms and further particulars, stating briefly age, qualifications and experience, to the Recruitment Attaché, Office of the High Commissioner for Nigeria, Nigeria House, 9 Northumberland Avenue, London, W.C.2., quoting B.3/4.

FEDERAL GOVERNMENT OF NIGERIA

SPECIALIST OFFICER

(PLANT NEMATOLOGIST)

REQUIRED by the Federal Department of Agricultural Research, Moor Plantation, Ibadan, to carry out the identification and study of plant diseases caused by nematodes, and to devise practical control measures.

Candidates must possess a University Degree in Natural Science (Botany or Zoology) with First or Second Class Honours, plus two years post-graduate experience or training in the study of plant parasitic nematodes. Candidates should be between the ages of 22 and 30 years of age. The post is not open to women candidates.

Appointment on contract for two tours of 18-24 months in the first instance with prospect of extension. Salary according to qualifications and experience in the scale £1,404—£2,196 per annum (including Inducement Addition). Gratuity of £150 per annum on salaries under £1,741. Free passages for officer and wife. Children's allowances while separated. Liberal home leave on full pay. Income tax at low local rate. Quarters at low rent.

Write for application forms and further particulars, stating briefly age, qualifications and experience, to the Recruitment Attaché, Office of the High Commissioner for Nigeria, Nigeria House, 9 Northumberland Avenue, London, W.C.2., quoting B.16/4.

OFFICIAL APPOINTMENTS

FEDERAL GOVERNMENT OF NIGERIA

PRINCIPAL FISHERIES RESEARCH OFFICER

REQUIRED by the Federal Fisheries Service, to carry out research on problems connected with the fishing industry in Nigeria, with particular reference to inland fisheries; projects in view include a study of the fish of Lake Chad, and of the Niger fish in relation to the proposed hydro-electric scheme. The officer appointed may also be required to engage in marine research and to carry out headquarters administrative duties. He will supervise the work of recently graduated officers and train them in the conduct of research.

Candidates must possess an honours degree in Zoology with at least five years post-graduate research experience in freshwater biology, fisheries science or a cognate subject. A good record of published work would be expected.

Appointment on contract for two tours of 12-24 months in the first instance with prospect of extension. Salary £2,340 (including Inducement Addition) per annum, plus gratuity of £150 per annum for satisfactory service. Free passages for officer and wife. Children's allowances while separated. Liberal home leave on full pay. Income tax at low local rates. Quarters at low rent.

Write for application forms and further particulars, stating briefly age, qualifications and experience, to the Recruitment Attaché, Office of the High Commissioner for Nigeria, Nigeria House, 9 Northumberland Avenue, London, W.C.2., quoting H.1/4.

FIELD OFFICERS (Agriculture)

required by TANGANYIKA GOVERNMENT for the following duties:

M3A/53406/AAC *either* the field work of farm plans, reconnaissance surveys and assessment of optimum land usage both for dryland and irrigation farming (land and farm planning experience essential) *or* irrigation extension work which may involve duties on an irrigation experiment station.

M3A/53477/AAC. To supervise a farm institute for teaching African farmers or to teach at an agricultural school. Teaching experience essential.

M3A/53479/AAC. To supervise development of small holder tea-growing schemes and establish/develop tea nurseries. Tea-growing experience essential.

M3A/53480/AAC. Agricultural extension work mainly among African farmers. Candidates should have a practical knowledge of agricultural tractors and machinery and extensive experience in crop and animal husbandry.

Appointment on contract for one tour of 21-27 months in first instance. Commencing salary according to qualifications and experience in scale (including Overseas Addition) £1,056 to £1,671 a year. Gratuity 25% total salary drawn. Outfit allowance £45. Free passages. Liberal leave on full salary.

Candidates should possess a College or National Diploma in Agriculture as well as the relevant practical experience.

Apply to CROWN AGENTS, 4 Millbank, London, S.W.1. for application form and further particulars, stating age, name, brief details of qualifications and experience and quoting the reference relating to the post preferred.

FEDERAL GOVERNMENT OF NIGERIA

SPECIALIST OFFICER

(SPECTRO-CHEMIST)

REQUIRED by the Federal Department of Agricultural Research, Moor Plantation, Ibadan, to take charge of Spectrochemistry work for analysis of soils and plant materials.

Candidates must possess a University Degree in Natural Science (Chemistry or Analytical Chemistry) with First or Second Class Honours, plus two years post-graduate experience or training in relation to Spectrochemistry, with special reference to practical physics. Candidates should be between the ages of 22 and 30 years. The post is not open to women candidates.

Appointment on contract for two tours of 18-24 months in the first instance with prospect of extension. Salary according to qualifications and experience in the scale £1,404—£2,196 per annum (including Inducement Addition). Gratuity of £150 per annum on satisfactory completion of tour. Outfit allowance of £60 on salaries under £1,741. Free passages for officer and wife. Children's allowances while separated. Liberal home leave on full pay. Income tax at low local rates. Quarters at low rent.

Write for application forms and further particulars, stating briefly age, qualifications and experience, to the Recruitment Attaché, Office of the High Commissioner for Nigeria, Nigeria House, 9 Northumberland Avenue, London, W.C.2., quoting B.15/4.

FEDERAL GOVERNMENT OF NIGERIA

SPECIALIST OFFICER

(ENTOMOLOGIST)

REQUIRED by the Federal Department of Agricultural Research, Ibadan, to be employed on studies of insect pests of plants and plant products, and to devise practical control methods, with special reference to yam beetle investigations.

Candidates must possess a University First or Second Class Honours Degree in Natural Science (Zoology or Entomology) plus two years' post-graduate experience or training. Only candidates between the ages of 22 and 30 years will be considered.

Appointment on contract for two tours of 18-24 months in the first instance with prospect of extension. Salary according to qualifications and experience in the scale £1,434—£2,196 per annum (including Inducement Addition) plus gratuity of £150 on satisfactory completion of service. Outfit allowance of £60 on salaries under £1,741. Free passages for officer and wife. Children's allowances while separated. Liberal home leave on full pay. Income tax at low local rate. Quarters at low rent.

Write for application forms and further particulars, stating briefly age, qualifications and experience, to the Recruitment Attaché, Office of the High Commissioner for Nigeria, Nigeria House, 9 Northumberland Avenue, London, W.C.2., quoting B17/4.

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